Refrigeration Service Engineer

Vol. 5
No. 9

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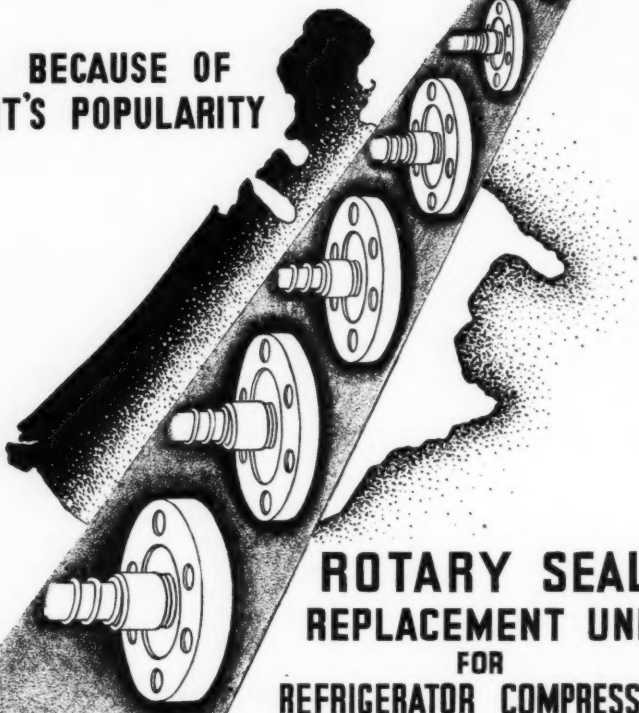

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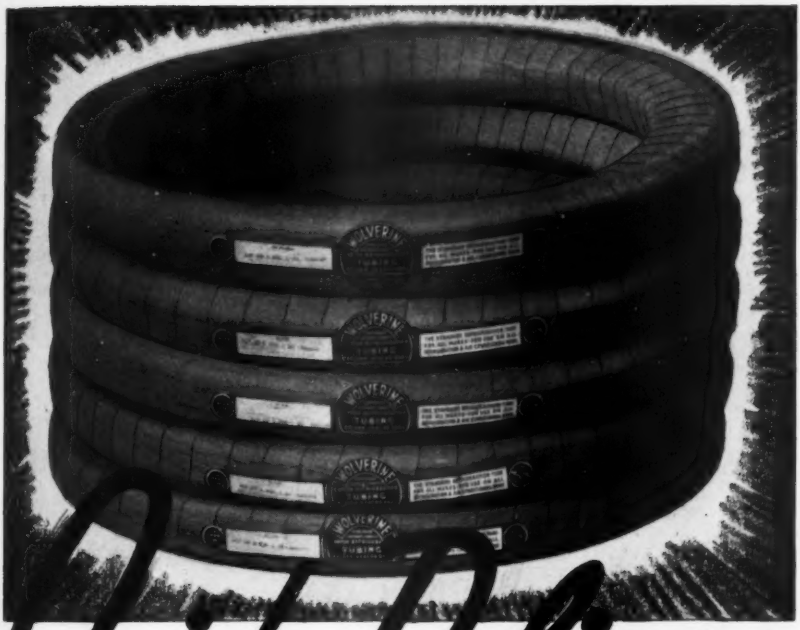

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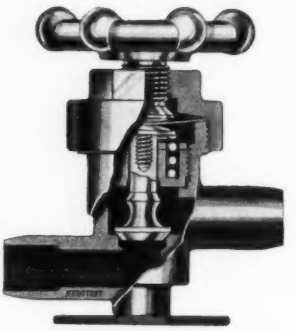

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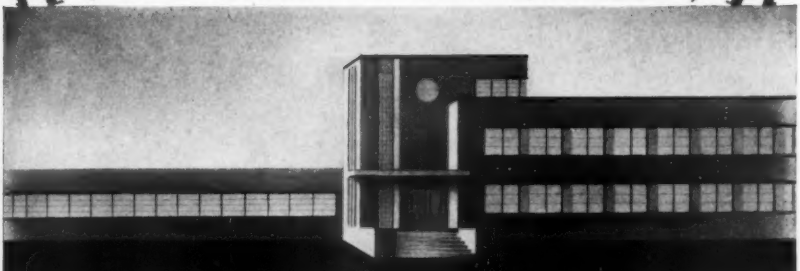

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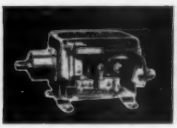

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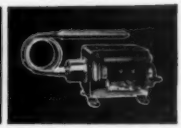

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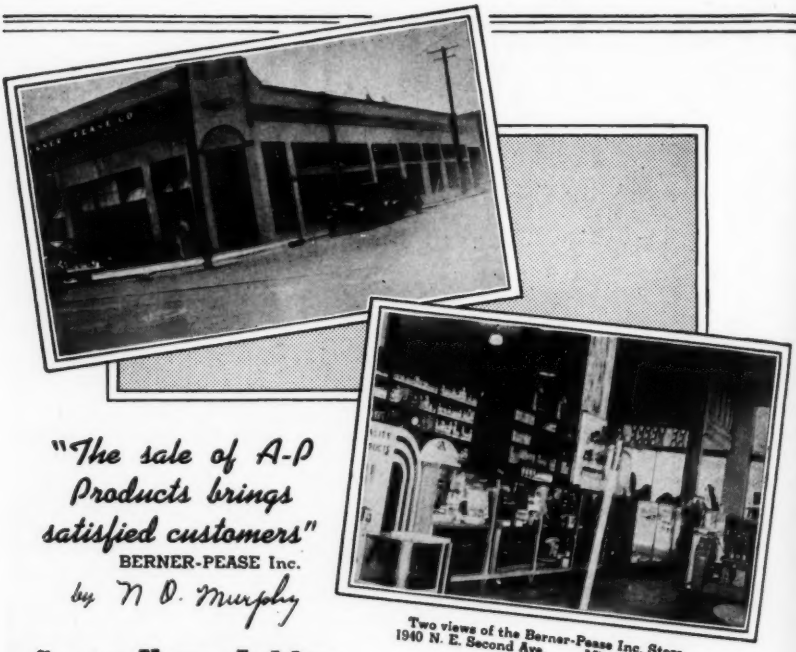

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by N. D. Murphy

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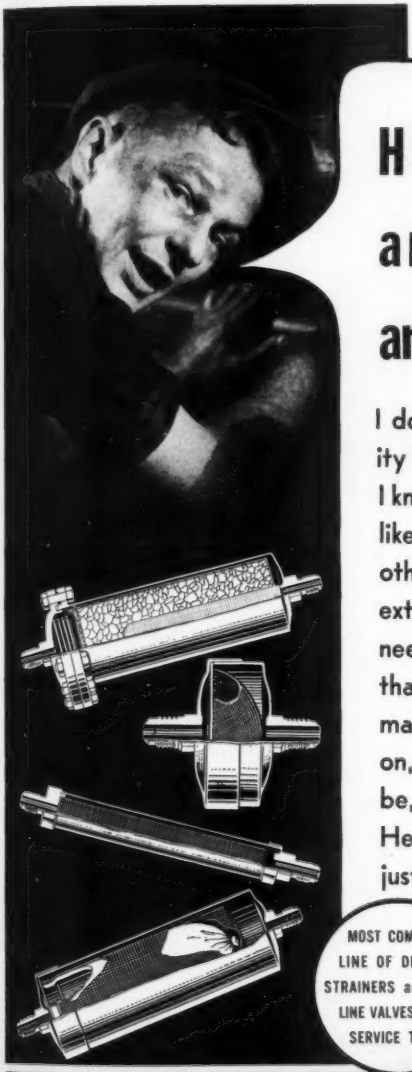

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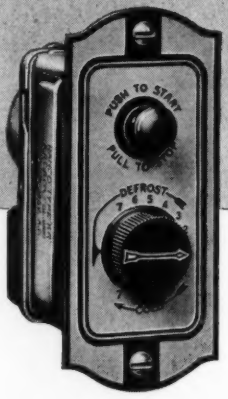

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The Refrigeration Service Engineer

Vol. 5 No. 9

September, 1937

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

COVER

This month's cover shows an inside view of All Makes Refrigeration Sales and Service Co. shop. Note the stock of repaired compressors, evaporators and motors which are used for the exchange repair service. The article on page 19 describes this shop in further detail.

Published by
Nickerson & Collins Co.
433-435 North Waller Ave.
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EASTERN OFFICE
149 Broadway, New York City
Telephone Barclay 7-8275

Publishers of Technical Books and Trade Journals Serving the Refrigeration Industries for 46 years.

Subscription Rates United States $2.00 per year. Single copies 25c. All other countries $3.00 per year.

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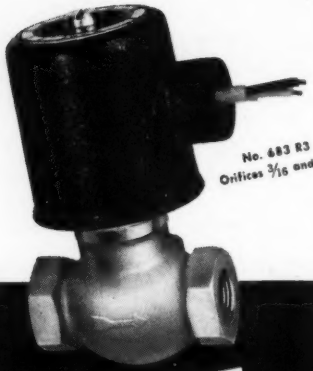

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The Refrigeration Service Engineer

VOL. 5, No. 9 CHICAGO, SEPTEMBER, 1937 $2.00 Per Annum

Heating and Air Conditioning

This, the First of a Series of Articles on The Subject Deals with Fundamentals.

By H. D. BUSBY

LOOKING into the future of the air conditioning industry, it is easy to conceive within a very short time, the growth in popularity of air conditioning in the home to the place of the household refrigerator of today. Many modern homes are already so equipped, and the increase in this equipment will be in far greater proportion to the increase in new homes being built. Most new homes, of course, are making provisions for air conditioning, and in so doing, they are increasing the demand and popularity for it. But soon no modern home will be complete without it. So it is with electric refrigeration.

Manufacturers of air conditioning equipment, in order to reduce the cost to a minimum and to increase the percentage of the year during which the equipment can be used, are combining both heating and cooling equipment into one central plant, which will gradually replace the present-day heating system.

These systems are designed to burn coal, gas or oil as a fuel, and in the most part are automatically controlled and will, no doubt, require service from time to time.

Coupled with this thought is the desirability of combining the oil burner and stoker service business with refrigeration service in order to level out the peak loads of work between winter and summer.

It is not a very big step from the knowledge required in heating to that required in refrigeration, or vice versa. In fact, they are very similar. In one we add heat, while in the other we are removing heat, and the mathematics of doing each are very much alike.

It is with these thoughts in mind that the articles on Heating and Air Conditioning are being published. These articles will cover, in brief, a complete course in heating, which it is hoped will give the serviceman, coupled with his experience in refrigeration, a good working knowledge of heating, so that he may prepare himself for the future air conditioning equipment in both its functions of heating and cooling, and that he may, if he so desires, extend his field of work to the service of heating appliances as they are found today.

CHAPTER I.
FUNDAMENTALS AND DEFINITIONS OF UNITS

Heat Defined

Heat is a physical agent or form of energy generated by or converted from some

other form of energy by combustion, chemical action or friction. We have one natural source of heat, which is the sun, but since it does not represent a source with which we can deal in this treatise, we will not give it any further consideration.

Heat, when added to or removed from a substance, will affect it by changing the temperature, changing the volume or changing the state of the substance, or perhaps will change all three. For example, we can consider ice. By adding heat, we change the ice to water; then the volume of the water increases with the heat added. Next we change the water to steam, and by the further addition of heat, we increase the volume of the steam. Thus, in the process of adding heat, we have twice changed the state of the substance and twice increased its volume.

Physical Laws of Heat

For the purpose of standardizing calculations, 460 degrees F. below zero has been determined as the temperature at which no heat is present. This is known as absolute zero, and all substances at a temperature above absolute zero contain heat.

Heat seeks its own temperature level and travels by three means—radiation, conduction and convection. Definitions of these means will be given in Chapter II.

When a substance changes its state from a solid to a liquid, or a liquid to a vapor, it absorbs heat without changing its temperature. In the case of ice, for example, heat is required to change ice at 32 degrees F. to water at 32 degrees F., and again from water at 212 degrees F. to steam at 212 degrees F. More heat added to the water at atmospheric pressure will not increase its temperature over 212 degrees F., but will make it boil more rapidly.

Boiling temperatures of liquids change when the pressure under which they are maintained is changed. An increase in pressure raises the boiling point, and a decrease in pressure lowers the boiling point.

Heat Unit Defined

The unit for measuring heat is called the British thermal unit (B.t.u.) and is commonly known as the amount of heat required to raise the temperature of one pound of water one degree F. It is equal to 1/180 of the amount of heat required to raise the temperature of one pound of water from 32 degrees F. (freezing point) to 212 degrees F. (boiling point at atmospheric pressure).

Kinds of Heat

In dealing with heat, we have three classifications or kinds of heat to consider, as follows:

Sensible Heat is the heat required to change the temperature of a substance without changing its state. This is commonly thought of as the heat we can feel.

Latent Heat, or the amount of heat required to change the state of the substance without changing its temperature. Further terms used in this connection are: *Latent Heat of Fusion*—the amount of heat required to change a substance from a solid to a liquid; *Latent Heat of Evaporation*—the amount of heat required to change from a liquid to a vapor. The latent heat of evaporation for water is 970.4 B.t.u.'s

Specific Heat is the number of B.t.u.'s required to change one pound of any substance one degree F. It is a ratio of the heat capacity of any substance to that of water.

Measurement of Heat

From the foregoing classifications, or kinds of heat, we can set up formulae for the measurement of the total heat in any substance, as follows:

Heat required to change the temperature of a substance without a change in state will equal:

Pounds × Specific Heat × Temperature Change.

Heat required to change the state without a change of temperature equals:

Pounds × Latent Heat of Fusion or Evaporation.

Heat required to change the state and temperature of a substance (assuming a solid to a liquid) will equal:

Pounds × Specific Heat of Solid × Temperature Change to the Melting Point + Pounds × Latent Heat of Fusion + Pounds × Specific Heat of Liquid × Temperature Change to the Final Temperature of the Liquid.

Assuming a liquid to a vapor, we would have:

Pounds × Specific Heat of Liquid × Temperature Change to the Boiling Point + Pounds × Latent Heat of Evaporation.

Referring to Fig. 1, we see portrayed diagrammatically, the amount of heat required to raise one pound of ice at 0 degrees F. to steam at an undetermined temperature and pressure.

Since the specific heat of ice equals .5, we see that the B.t.u.'s required to raise one pound of water from 0 degrees F. to 32 degrees F. (Point A to B) equals $1 \times (32-0) \times .5 = 16$ B.t.u.

Points B to C indicate the latent heat of fusion of ice or B.t.u.'s required to change ice at 32 degrees F. to water at 32 degrees F., which is 144 B.t.u.

Points C to D indicate the B.t.u.'s required to raise one pound of water from 32 degrees F. to 212 degrees F., which equals: Pounds × Specific Heat × Temperature Change $= 1 \times 1.0 \times (212-32) =$ 180 B.t.u.

Points D to E indicate the latent heat of evaporation for water, which is the B.t.u.'s required to change one pound of water to steam at atmospheric pressure, or 970.4 B.t.u.

Other Units Commonly Used

Temperature may be defined as the indication of the degree of sensible heat of a substance measured in degrees Fahrenheit or Centigrade. The temperature may be stated in degrees F. above absolute, or in degrees F. above or below zero.

Pressure is the resultant force set up when a vapor is compressed, or when two substances are pressed together. It is usually measured and expressed as follows:

Pounds per Square Inch

One pound per square inch equals ..... { 2.0446 inches HG / 2.309 feet water / 27.11 inches water

Inches of Mercury

One inch of mercury equals ..... { .491 lbs. per square inch / 13.58 inches water

Inches of Water

One inch of water equals ..... { .03609 lbs. per square inch / .5774 oz. per square inch

Specific Gravity

The specific gravity of a solid or a liquid is the ratio of the weight of a given volume of a substance to an equal volume of water.

In the specific gravity of gases or vapors, the ratio is between the weight of the gas to an equal volume of air.

Water, or air, as the case may be, is usually considered as 1.000 and by referring to specific gravity tables of various substances, we may determine the weight of the substance as expressed in relation to that of water or air.

Examples

From the foregoing definitions and figures, it is possible to set up certain exam-

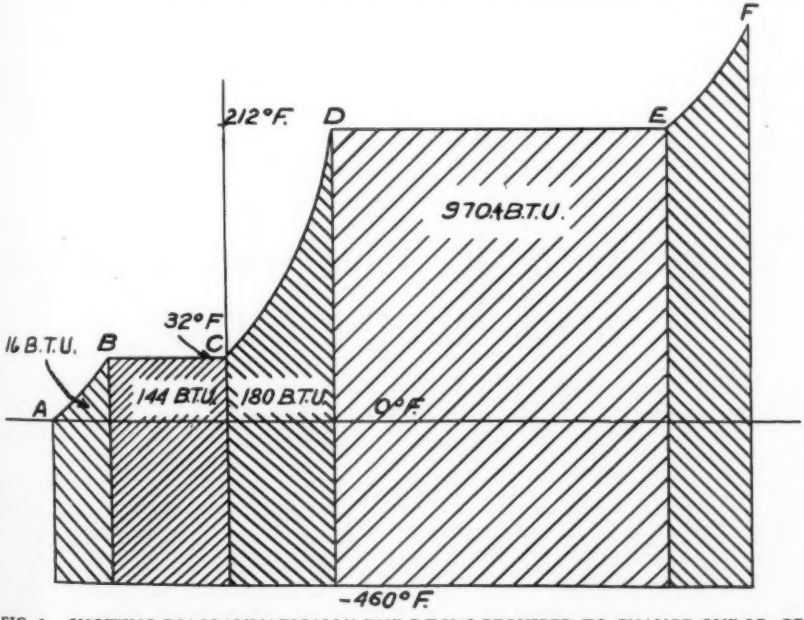


FIG. 1. SHOWING DIAGRAMMATICALLY THE B.T.U.'S REQUIRED TO CHANGE ONE LB. OF ICE AT 0 DEGREES F. TO STEAM AT AN UNDETERMINED PRESSURE AND TEMPERATURE.

ples using these terms, which will probably clarify them further.

1. The number of B.t.u.'s required to change 15 lbs. of water from 35 degrees to 95 degrees F. will become:

Pounds × Specific Heat × Temperature Change = B.t.u.

or

$15 \times 1 \times (95-35) = 900$ B.t.u.

2. B.t.u.'s required to change 10 lbs. of water at 60 degrees F. to steam at 212 degrees F. atmospheric pressure equals:

Pounds × Specific Heat × Temperature Change to the Boiling Point + Pounds × Latent Heat of Evaporation

or

$10 \times 1 \times (212-60) + (970.4 \times 10) =$ 11224 B.t.u.

3. The B.t.u.'s required to change 25 lbs. of ice at 10 degrees F. to steam at 212 degrees F. atmospheric pressure will be:

Pounds × Specific Heat of Ice × Temperature Change to Melting Point + Pounds × Latent Heat of Fusion of Ice + Pounds × Specific Heat of Water × Degrees Change to the Evaporating Temperature + Pounds × Latent Heat of Evaporation, which equals:

$25 \times .5 \times (32-10)$	= 275 B.t.u.
25×144	= 3600 B.t.u.
$25 \times 1 \times (212-32)$	= 4500 B.t.u.
25×970.4	= 24260 B.t.u.
Total	32635 B.t.u.

4. If water enters a radiator at 150 degrees F. and leaves at 120 degrees F. at the rate of 10 lbs. per minute, how many B.t.u.'s would be dissipated through the radiator per minute? How many pounds of steam at atmospheric pressure would be required to condense to produce the same results?

Solution A. The temperature reduction in the water equals 150 degrees — 120 degrees = 30 degrees F. Specific heat of water equals 1.0.

Therefore $10 \times 1 \times (150-120) = 300$ B.t.u. per minute.

Solution B. Since the latent heat of evaporation of steam is 970.4 B.t.u. per pound, the pounds of steam required becomes $\frac{300}{970.4}$ or .309 per minute.

5. The number of pounds per square inch equivalent to 5 inches of water pressure would be determined as follows:

14.7 lbs. per square inch (atmospheric pressure) is equivalent to the pressure created by a column of water 33.947 ft. or 407.364 inches high.

One pound pressure = $\frac{407.364}{14.7}$ or 27.71 inches of water.

Therefore 5 inches of water = $\frac{5}{27.71}$ = .18045 lbs. per square inch.

This article will be continued in October.

Velocities in Suction Mains and Evaporators

Second of a Series of Articles and Tables Giving Velocities in Suction Mains and Evaporators with Load Carrying Capacity of Coils for Methyl Chloride

By J. O. SCHULTZ *

THE pressures in the suction side of methyl chloride refrigerating systems being comparatively low and the vapors being saturated, the velocities of the vapor in the suction mains must be held within reasonable limits to prevent too great a loss of pressure, and to determine what a reasonable velocity is I would suggest that we compare this velocity to the accepted standards set for ammonia which have been in use for many years. (See previous article on same subject for anhydrous ammonia.)

(Continued on Page 19)

* Chief Engineer, Rempe Co., Chicago.

TABLE II — Velocity in Suction Mains and Evaporators With Maximum Load Carrying Capacity of Coils

CH_3Cl Methyl Chloride—86° Condensing Temp.—Liquid Heat Content 59.346

Suction Temp. °Fahr.	Vapor Volume Cu. Ft. per Lb.	Velocity in Suction Main, Ft. per Min.	Heat Content of Liquid at Evap. Temp.	B.t.u. to Cool Lq. to Evaporator Temp.	Latent Heat of Vaporization	Per Cent Vaporized to Cool Liquid	Velocity at Coil Outlet, Ft. per Min.	Heat Content of Vapor	Vapor Heat Less Liquid Heat	Lbs. of Refrigerant Circulated per Min. per Ton Refrig.	Displacement Cu. In per Min. per Ton Refrigeration	Maximum Load Carrying Capacity of Single Continuous Coils					
												½ In. Tube 0.12756 Sq. In. Area		⅝ In. Tube 0.2419 Sq. In. Area		⅞ In. Tube 0.34937 Sq. In. Area	
												Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour
10	6.55	4379	14.20	45.15	180.45	25.0	912	194.5	135.15	1.480	15984	0.0873	1048	0.1656	1987	0.2384	2861
9	6.07	4309	14.70	44.65	180.35	24.8	896	194.9	135.55	1.475	15471	0.0887	1064	0.1685	2018	0.2422	2906
8	5.94	4874	15.20	44.15	180.15	24.5	887	195.3	135.95	1.467	15099	0.0899	1079	0.1705	2046	0.2455	2946
7	5.80	4891	15.70	43.65	180.10	24.2	874	195.7	136.35	1.467	14703	0.0910	1092	0.1726	2071	0.2485	2982
6	5.70	4177	16.20	43.15	180.00	24.0	863	196.0	136.65	1.464	14480	0.0916	1099	0.1737	2084	0.2502	3002
5	5.60	4148	16.58	42.77	179.90	23.8	855	196.4	137.05	1.459	14118	0.0927	1112	0.1758	2110	0.2532	3038
4	5.47	4098	16.96	42.39	179.82	23.6	844	196.8	137.45	1.455	13753	0.0939	1127	0.1781	2137	0.2564	3077
3	5.37	4055	17.46	41.89	179.66	23.3	833	197.2	137.85	1.451	13464	0.0947	1136	0.1796	2155	0.2586	3103
2	5.25	4011	17.94	41.41	179.55	23.1	823	197.5	138.15	1.448	13126	0.0959	1151	0.1819	2183	0.2619	3143
1	5.15	3972	18.42	40.93	179.40	22.8	813	197.8	138.45	1.445	12859	0.0968	1162	0.1836	2203	0.2644	3173
0	5.05	3935	18.88	40.47	179.28	22.6	804	198.2	138.85	1.440	12566	0.0979	1175	0.1857	2228	0.2674	3207
1	4.95	3897	19.34	40.01	179.15	22.3	794	198.6	139.25	1.436	12283	0.0989	1187	0.1876	2251	0.2701	3241
2	4.81	3843	19.80	39.55	179.00	22.1	782	198.9	139.55	1.431	11911	0.1005	1206	0.1906	2287	0.2745	3294
3	4.70	3797	20.26	39.09	178.85	21.9	771	199.2	139.85	1.430	11614	0.1016	1219	0.1927	2312	0.2775	3330
4	4.60	3757	20.72	38.63	178.71	21.6	761	199.5	140.15	1.427	11343	0.1027	1232	0.1948	2338	0.2805	3366
5	4.53	3724	21.20	38.15	178.56	21.4	753	199.8	140.45	1.424	11147	0.1034	1241	0.1961	2353	0.2824	3389
6	4.46	3696	21.67	37.68	178.40	21.1	746	200.3	140.95	1.419	10936	0.1044	1253	0.1980	2376	0.2851	3421
7	4.38	3661	22.14	37.21	178.27	20.9	738	200.5	141.15	1.417	10725	0.1053	1264	0.1997	2396	0.2876	3451
8	4.30	3632	22.61	36.74	178.14	20.6	730	200.8	141.45	1.414	10507	0.1064	1277	0.2018	2422	0.2906	3487
9	4.22	3597	23.08	36.27	178.00	20.4	722	201.2	141.85	1.410	10288	0.1075	1290	0.2039	2447	0.2936	3523
10	4.15	3571	23.55	35.80	177.85	20.1	715	201.5	142.15	1.407	10090	0.1085	1302	0.2058	2470	0.2963	3556

TABLE II-CONT. -VELOCITY IN SUCTION MAINS AND EVAPORATORS WITH MAXIMUM LOAD CARRYING CAPACITY OF COILS

CH_3Cl Methyl Chloride—86° Condensing Temp.—Liquid Heat Content 59.346

11	4.05	3524	24.02	35.33	177.70	19.9	704	201.8	142.45	1.404	9826	0.1097	1316	0.2080	2496	0.2996	3595
12	3.97	3485	24.49	34.86	177.56	19.6	695	202.1	142.75	1.401	9611	0.1107	1328	0.2099	2519	0.3023	3628
13	3.89	3450	24.96	34.39	177.43	19.4	687	202.4	143.05	1.398	9397	0.1119	1343	0.2122	2546	0.3056	3667
14	3.80	3412	25.43	33.92	177.30	19.1	677	202.7	143.35	1.395	9160	0.1131	1357	0.2145	2574	0.3089	3707
15	3.70	3365	25.90	33.45	177.27	18.9	667	203.1	143.75	1.391	8893	0.1148	1378	0.2177	2612	0.3135	3762
16	3.64	3342	26.37	32.98	177.04	18.6	661	203.4	144.05	1.388	8750	0.1156	1387	0.2192	2630	0.3157	3788
17	3.58	3310	26.84	32.51	176.92	18.4	653	203.7	144.35	1.386	8574	0.1166	1399	0.2211	2653	0.3194	3833
18	3.50	3275	27.31	32.04	176.77	18.1	645	204.1	144.75	1.382	8358	0.1181	1417	0.2240	2688	0.3225	3870
19	3.44	3247	27.78	31.57	176.62	17.8	637	204.4	145.05	1.379	8197	0.1190	1428	0.2257	2708	0.3250	3900
20	3.37	3217	28.25	31.10	176.52	17.6	631	204.7	145.35	1.376	8013	0.1205	1446	0.2285	2742	0.3291	3949
21	3.31	3188	28.72	30.63	176.32	17.4	624	205.0	145.65	1.373	7853	0.1216	1459	0.2306	2767	0.3321	3985
22	3.25	3156	29.19	30.16	176.18	17.1	616	205.4	146.05	1.369	7688	0.1226	1471	0.2325	2790	0.3348	4018
23	3.17	3118	29.67	29.68	176.04	16.9	607	205.7	146.35	1.367	7488	0.1241	1489	0.2353	2824	0.3389	4067
24	3.13	3100	30.14	29.21	175.90	16.6	602	206.1	146.75	1.363	7372	0.1250	1500	0.2370	2844	0.3414	4097
25	3.07	3069	30.61	28.74	175.76	16.4	595	206.4	147.05	1.360	7215	0.1262	1514	0.2393	2872	0.3447	4136
26	3.01	3037	31.08	28.27	175.60	16.1	588	206.7	147.35	1.357	7058	0.1275	1530	0.2418	2895	0.3483	4180
27	2.95	3009	31.56	27.79	175.44	15.8	581	207.0	147.65	1.355	6907	0.1288	1547	0.2443	2932	0.3518	4222
28	2.89	2977	32.03	27.32	175.28	15.6	574	207.3	147.95	1.352	6752	0.1301	1561	0.2467	2960	0.3553	4264
29	2.83	2942	32.50	26.85	175.14	15.3	565	207.6	148.25	1.349	6597	0.1311	1573	0.2486	2983	0.3580	4296
30	2.77	2914	32.97	26.38	175.00	15.1	559	207.9	148.55	1.346	6443	0.1328	1594	0.2518	3022	0.3627	4352
31	2.74	2897	33.44	25.91	174.80	14.8	554	208.2	148.85	1.344	6363	0.1333	1600	0.2528	3034	0.3640	4368
32	2.68	2865	33.91	25.44	174.60	14.6	547	208.5	149.15	1.341	6210	0.1348	1618	0.2556	3067	0.3681	4417
33	2.64	2839	34.38	24.97	174.46	14.3	541	208.8	149.45	1.338	6104	0.1357	1628	0.2573	3088	0.3706	4447
34	2.58	2813	34.85	24.50	174.30	14.1	535	209.1	149.75	1.335	5952	0.1376	1651	0.2609	3131	0.3758	4510
35	2.54	2787	35.32	24.03	174.17	13.8	529	209.4	150.05	1.333	5851	0.1384	1661	0.2625	3150	0.3780	4536
36	2.49	2766	35.79	23.56	173.94	13.5	523	209.7	150.35	1.330	5723	0.1397	1676	0.2649	3179	0.3815	4578
37	2.45	2736	36.26	23.09	173.76	13.3	517	210.0	150.65	1.328	5622	0.1408	1690	0.2670	3204	0.3845	4614
38	2.40	2715	36.73	22.62	173.58	13.0	511	210.3	150.95	1.325	5495	0.1423	1708	0.2699	3239	0.3886	4663
39	2.36	2692	37.20	22.15	173.39	12.8	506	210.6	151.25	1.322	5391	0.1437	1724	0.2725	3270	0.3924	4709
40	2.32	2666	37.67	21.68	173.20	12.5	500	210.9	151.55	1.320	5292	0.1446	1735	0.2742	3290	0.3949	4739

Properties of Methyl Chloride Approximated from Tables Through Interpolation and Charts

VELOCITIES IN MAINS

(Continued from Page 16)

Methyl chloride is heavier than ammonia and therefore the velocity, that is to be recommended, is less than for anhydrous ammonia and can be proportioned in direct ratio to the square root of the volume, and on this basis the accompanying table has been prepared.

A refrigerating system operating at 14 degrees suction and 86 degrees liquid temperature requires a displacement of 9160 cu. in. at 100 per cent efficiency and a suction main velocity of 3412 ft., per minute. A ½-in. copper tube with an internal area of 0.12756 sq. in. can be used for a system of 0.57 tons capacity or 6840 B.t.u. per hour, whereas a ⅝-in. tube with an area of 0.2419 sq. in. can be used for a capacity of 1.0812 tons or 12,974 B.t.u. per hour.

With 14 degrees suction an evaporator made of ½-in. tube has a carrying capacity of 1357 B.t.u. per hour, whereas one made of ⅝-in. tube has nearly 90 per cent greater capacity or 2574 B.t.u. per hour.

The size of the tubing to be used in methyl chloride refrigerating systems should be given thorough consideration as this refrigerant graduated from the household class and while in the later class, the use of ½-in. tubing was acceptable for evaporators, but when used for refrigerators having a refrigerating load of 6000 to 12,000 B.t.u. per hour it is necessary to go into larger tubing sizes, and the use of ¾-in. tubing will no doubt be used for the larger refrigerators.

Changes in the condensed liquid temperature do not materially affect the coil outlet velocities. With liquid temperature of 100 degrees, which is a fair air-cooled temperature, the coil carrying capacity at —10 degrees F. is reduced 2.4 per cent; at +5 degrees F. reduced 2 per cent; and at +40 degrees F. reduced 1 per cent. See Table II. for velocities of methyl chloride.

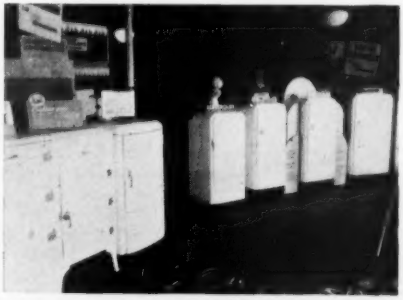
Appearing in the October issue will be an article on F12.

The R. S. E. Goes on a Service Call

FRED ROTH.

RECENTLY we decided in order to vary our experience slightly, we would apply for a job as a service engineer. After looking around a bit, we finally heard that the All Makes Refrigeration Sales & Service, Inc., were looking for a good man, and taking it for granted that we could fill the bill, we went over to 2407 Montrose Ave., Chicago, to see Mr. Fred Roth, general manager of the concern, with a view to securing the position.

We were met just inside the door by Mr. Fred Kautz, who we later learned was in charge of sales. Mr. Kautz politely offered to assist us in selecting the refrigerator we wished to buy, and since we wished to learn as much as possible about the business we had ambitions toward entering, we decided to let him go ahead with the thought that we were a prospective buyer and tell us all about it. In due course, we learned that we could buy almost any type of refrigerating equipment we might want, from the smallest household box to a large commercial set-up, at most any price we could afford to pay and at almost any terms we could meet. This equipment included such well-known



SALES FLOOR OF ALL MAKES REFRIG. INC.

SERVICE ROUTINE

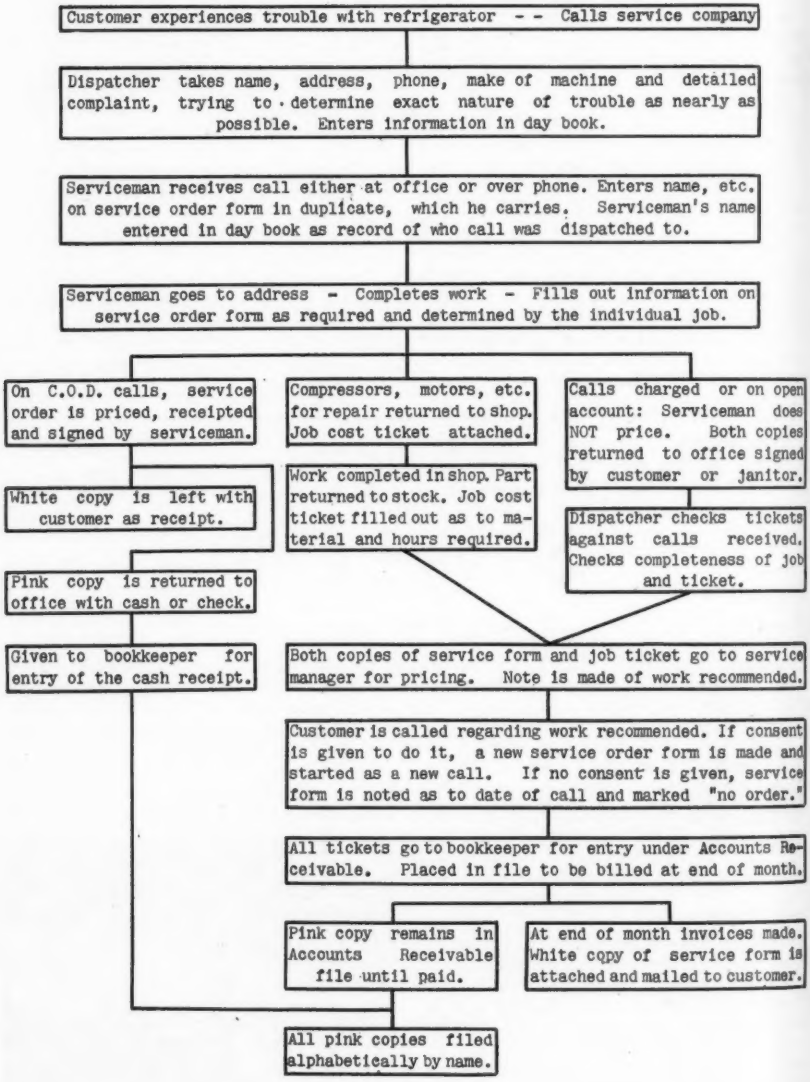

Customer experiences trouble with refrigerator -- Calls service company
Dispatcher takes name, address, phone, make of machine and detailed complaint, trying to determine exact nature of trouble as nearly as possible. Enters information in day book.
Serviceman receives call either at office or over phone. Enters name, etc. on service order form in duplicate, which he carries. Serviceman's name entered in day book as record of who call was dispatched to.
Serviceman goes to address - Completes work - Fills out information on service order form as required and determined by the individual job.
On C.O.D. calls, service order is priced, receipted and signed by serviceman.
Compressors, motors, etc. for repair returned to shop. Job cost ticket attached.
Calls charged or on open account: Serviceman does NOT price. Both copies returned to office signed by customer or janitor.
White copy is left with customer as receipt.
Work completed in shop. Part returned to stock. Job cost ticket filled out as to material and hours required.
Dispatcher checks tickets against calls received. Checks completeness of job and ticket.
Pink copy is returned to office with cash or check.
Given to bookkeeper for entry of the cash receipt.
Both copies of service form and job ticket go to service manager for pricing. Note is made of work recommended.
Customer is called regarding work recommended. If consent is given to do it, a new service order form is made and started as a new call. If no consent is given, service form is noted as to date of call and marked "no order."
All tickets go to bookkeeper for entry under Accounts Receivable. Placed in file to be billed at end of month.
Pink copy remains in Accounts Receivable file until paid.
At end of month invoices made. White copy of service form is attached and mailed to customer.
All pink copies filed alphabetically by name.

FIG. 1. CHART SHOWING THE ROUTINE FOLLOWED BY A SERVICE CALL IN MR. ROTH'S SET UP.

makes of new domestic cabinets as Electrolux, Copeland and Universal Cooler, as well as a variety of used rebuilt cabinets. In new commercial equipment, we could secure such makes as Copeland, Reliance and Starr Freeze, as well as various makes and sizes of used equipment.

MR. FRED KAUTZ CAUGHT IN THE ACT OF TRYING TO SELL MISS BOSSERT AN ELECTROLUX.

During this time, it was interesting to note the arrangement of the merchandise on the floor. To the right as you enter, which is the direction the average person will normally turn, will be found the major line of refrigerators. These, of course, are the best they have to offer and the most desirable to sell. The compliment to the customer in offering the best first is usually well appreciated. Ranging toward the left of these, and downward in price, are the cheaper lines of cabinets, until finally you reach the used or rebuilt jobs. To the extreme left of the store as you enter is a display of commercial equipment. The windows likewise follow out the same general scheme. These are two large windows with the entrance in the center. The right hand window, as you face it, is devoted to domestic equipment, while the left is devoted to commercial.

We finally had to disappoint Mr. Kautz by informing him that we were not interested in buying anything, but were looking for a job. Naturally, this was quite a letdown to the sales instinct of Mr. Kautz after all the interest we had displayed in his talk, but he nevertheless took it goodnaturedly and referred us to Elvera Bossert, Mr. Roth's secretary.

As usual with all secretaries, we had a little difficulty in qualifying ourselves to get by this young lady, but after a little discussion on the matter, we were finally informed that Mr. Roth was busy for the moment and we were invited to make ourselves at home and look around the place. We were introduced to Mr. Percy Bossert, who is in charge of the shop, and he took us under his wing for the time.

We were much impressed by the completeness of this shop and with the orderly arrangement of its equipment. The equipment included such machines as two lathes—one a small bench lathe and one a much larger and longer lathe—a drill press, a compressor test stand, a thermostat testing machine, an automatically controlled gas burning drying oven, an arbor press, a spray room fully equipped, a motor repair and test bench, a compressor repair bench, and another general repair bench.

Work on Exchange Repair Basis

We were informed by Mr. Bossert that the business was conducted as far as possible on an exchange repair basis, which we found out means that when such parts as compressors, motors, evaporators, floats, etc., were found to be in need of repair, they are replaced with a repaired part from stock, rather than repairing the original one, thus speeding up service and saving the necessary time of making a second call on the premises, the stock being eventually replenished with the original one when repaired. To facilitate this set-up, the stock of equipment includes a variety of different makes and sizes totaling:

83 compressors
125 motors
22 complete high sides
170 evaporators
75 high and low side floats

Expansion valves and thermostats, we learned, could not be handled efficiently on this basis, but they did offer a small trade-in

FRONT VIEW OF ALL MAKES REFRIGERATION SERVICE INC. WITH THE PERSONNEL GROUPED IN DOORWAY.

KEYSTONE 2406-7 — Night and Sunday Phone SHELDRAKE 1575

Member — MASTER REFRIGERATION ASSOCIATION — SERVICE & INSTALLATION — ILLINOIS

All Makes Refrigeration
Sales & Service, Inc.
COPELAND SALES AND SERVICE
INSTALLATION — REBUILDING — REPAIRING
2407-9 MONTROSE AVENUE
Member of Steam Fitters Branch, Local Union 597, U.A.

EFFICIENT REFRIGERATION SERVICE

Chicago, Ill., Aug 15 193 7

Service to 1690 N. Lamon Ave Apt 2A.
Bill to Chicago Management Co Order No. 112 75
Address 504 S. LaSalle St
Make of Refrigerator Frigidaire Model EE5
Serial No. 1224758 Motor Dalco 1/6 HP. 3950

Charge	C. O. D.	Repeat	Guarantee	Contract	No Chg.
✓					

H. Pres. 70# | Low Pres. -10 | S. W. Cut In 5# | S. W. Cut Out -10

Complaint Won't Freeze

Work Done
checked entire unit - Found dirty condenser, loose belt - Slight leak at discharge shut off valve

Work Recommended and Cost
Motor overhaul - loose bearings - dirty - commutator needs Soldering
called Chicago Manag. Aug 15/37 no order

Material Used

2# SO2	1	00
2 flare nuts		25
Total Material	1	25
Tax		04
1 hr. Labor	3	30
Total Charge	4	59

Service Man F.H.R.
TERMS — Open Acc.

And to secure the payment of said amount.....hereby authorize, irrevocably, any attorney of any Court of Record to appear for.....In such Court, in term time or vacation, at any time hereafter, and confess a judgment, without process, in favor of the holder of this Note, for such amount as may appear to be unpaid thereon, together with costs and..... dollars attorney's fees, and to waive and release all errors which may intervene in any such proceedings, and consent to immediate execution upon such judgment, hereby ratifying and confirming all that.....said attorney may do by virtue hereof.

Signed Address
Tenant's Signature John Smith
Janitors Signature
Rec'd Payment $ Signature

FIG. 2. THE SERVICE ORDER FORM.

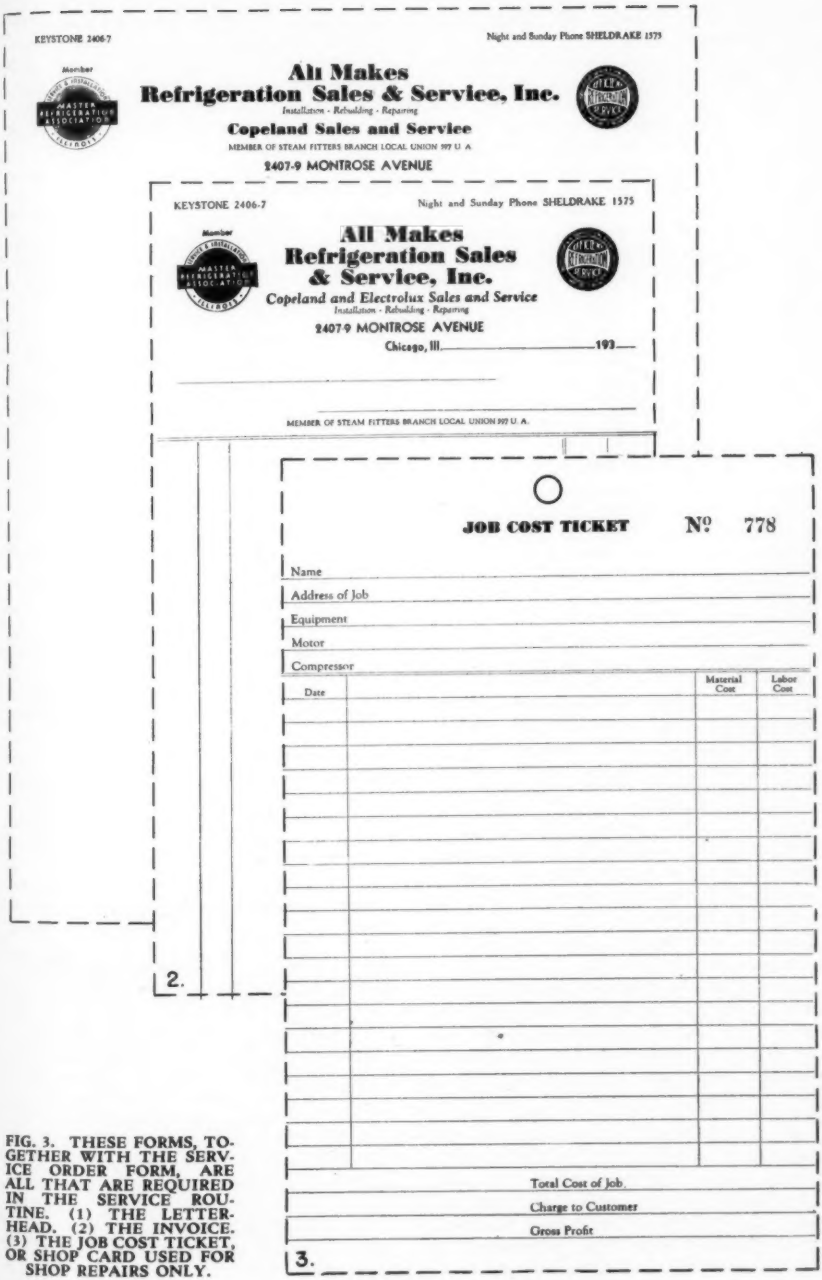


FIG. 3. THESE FORMS, TOGETHER WITH THE SERVICE ORDER FORM, ARE ALL THAT ARE REQUIRED IN THE SERVICE ROUTINE. (1) THE LETTERHEAD. (2) THE INVOICE. (3) THE JOB COST TICKET, OR SHOP CARD USED FOR SHOP REPAIRS ONLY.

allowance on these items and replaced them with new ones.

We became curious about the number of men employed in the service end of this business, and were informed that Bob Burger, Henry Heintz and Fred Bobzien were employed in the shop, in addition to Percy Bossert, and that Leo Roth and Pete Bendel took care of the field work. We were rather surprised to learn only two men were required in the field, but this was explained as due to the exchange policy, which brought most of the work to the shop. A further inspection of a three-car garage and an additional store space revealed a large stock of old equipment, which had been taken in on trade through the sales department. This stock represented considerable work for the winter months, in which time it would be put into good condition for sale during the following year.

We had learned a lot up to this point, and had almost forgotten our purpose in coming, but on sighting Mr. Roth coming out of his private sanctum, we were suddenly reminded, and started out to grab him before someone else did.

We made our desires known to Mr. Roth, and then waited with anxiety for the decision. He looked us over with a very critical eye, felt our muscles, pricked our skin to determine how thick it was, banged around on our skull, apparently looking for telltale bumps, and finally administered a dose of sulphur to see how well we could take it. We have to admit that we were getting pretty discouraged by this time, but were determined to stick it out, if possible.

Just to see how quickly we caught on, he decided to take us through the routine traveled by the average service call, and this we found to be much more to our liking and very interesting.

The Routine

The greater part of the work received by the All Makes Refrigeration Sales and Service, Inc., it appears, is through real estate and management houses. These are, as explained, open accounts and payable monthly. A standing agreement between the customer and service company permits the latter to do any job up to $15.00 without consulting the customer further. On jobs running over this amount, permission to proceed is secured first from the customer. The routine of each service call is followed as outlined in the service routine chart, Fig. 1. A total of four forms is required, including their letterhead, the invoice, the job cost ticket, and the service order form. All of these are shown in Figs. 2 and 3. According to Mr. Roth, a very valuable part of this service form is the judgment note contained at the bottom of the form. This is intended for the individual customer who permits the work to be completed, and then tells the serviceman to "charge it." In such cases, the judgment note is filled in and the customer signs it. At the end of the month they are billed, and if they happen to be one of the kind who feels you can "charge it" indefinitely, Mr. Roth claims that he merely turns the signed copy over to a lawyer, and he has no trouble in forcing payment. Incidentally, the attorney's fees are usually set at a minimum of $25.00, as shown in the space provided in the judgment form.

We were beginning to pat ourselves on the back by this time, because we felt we had "caught on" pretty well to the intricacies of the service routine. However, Mr. Roth seemed to be one of these "perfectly horrid men" who insist on keeping us poor girls in suspense, and consequently, we didn't get much encouragement. We were beginning to wonder how his wife ever married such a man!

Figures Show Trend

The trend of conversation turned next to business conditions in the refrigeration game, and the prospects of the future. After we had listened to Mr. Roth for sometime on this subject, we somewhat gathered the opinion that he was starting on his second million now, and is still going strong. Some actual figures, however, revealed a very substantial general improvement in conditions in the fact that during 1935, incollectibles amounted to 2.7 percent of the gross business, while 1936 shows only .25 percent incollectibles, and 1937 so far indicates a still further reduction in this item. The gross business showed an increase in 1936 of 200 percent over 1935, while 1937 to date indicates an increase of 100 percent over 1936.

We were quite enthused by this time, and convinced that we were making a step in the right direction by getting ourselves connected with the service game, since there was so much money to be made in it. We immediately got down to business and asked Mr. Roth how much he thought we were worth per week, and do you know that man actually insulted us. Anyway, he bought us a lunch, which helped to soothe our feelings and we decided to call it square and stick to our own game.

Fifth Article

Air Conditioning

Common Troubles and Their Remedy

By W. C. FARMINGDALE

IN the past two months the writer has been a field engineer for a large air conditioning manufacturer. His job has been to take the bugs out of new installations. In about 75 percent of the cases where poor operation has occurred, it was found that the cooling equipment was not properly balanced. Hence, it might be well to discuss how equipment should be balanced and perhaps discuss one or two of the troublesome jobs that result from improper balancing.

An air conditioning installation must be tailor-made from the original survey until the installation man tests the last joint for leaks.

To begin with, the engineer carefully considers all sources of heat-leakage into the space to be conditioned and then carefully calculates the number of Btu's the system must remove from the room air.

However, knowing the total number of Btu's to be removed is not enough. While the number of Btu's required to reduce the temperature of the air to the desired temperature, or what is commonly known as the sensible heat load is required, it is also necessary to know the number of Btu's required to reduce the humidity to a predetermined point. This load is called the latent heat load.

Selecting the Coil

When both of these loads are known, the engineer selects a cooling coil which has a sensible heat absorption slightly in excess of the sensible heat absorption required. When this is done, the latent heat absorption is generally in excess of that required.

The heat removing capacity of a cooling coil depends upon the temperature at which the coil operates. *As the temperature goes down, the cooling capacity of the coil goes up.* Hence the engineer in selecting the cooling coil to do the job, automatically selects the temperature and therefore the back pressure at which the system must operate.

Once the heat absorption and the operating back pressure is known, the proper size refrigerating machine can be selected.

The capacity of a refrigerating machine varies with the pressure at which the machine must operate. *As the back pressure goes down, the capacity of the refrigerating machine goes down.* Note that this is just the opposite way in which the cooling coil operates. *As the back pressure at the cooling coil goes down, the capacity of the cooling coil goes up.*

Where Trouble Begins

Right here is where the unbalanced condition usually starts. It is almost impossible to obtain a compressor with exactly the capacity required by the cooling coil. So to play safe, the engineer picks a refrigerating machine which has a greater capacity than that required.

When the refrigerating machine capacity is within 10 percent of that required, the back pressure of the system drops one or two pounds and no trouble results.

However, when the refrigerating machine capacity is more than 10 percent larger than is required, a number of difficulties are encountered.

To begin with, the excessive refrigerating machine capacity causes the system to operate at a very low back pressure. This creates one of the following undesirable conditions: either the unit produces too much cooling so that the user has to continually start and stop the machine to maintain a comfortable atmosphere, or the cooling coil frosts up and blocks the passage of air thru the cooling coil and thus stops cooling altogether.

A second trouble encountered on over-capacity jobs is a sweating of the greater part of the suction line. The reason for this is as follows: the thermostatic expansion valve at the entrance to the cooling coil insures that the suction gas which leaves the cooling coil is dry and superheated at least 10 degrees above the temperature of the liquid refrigerant in the cooling coil, but when the back pressure is very low, the suction gas is so cold that it cools the suction

line down to the dew point of the room air and this causes the suction line to sweat.

Failure of Water Removal System

A third trouble encountered on a system with an oversized refrigerating machine is a failure of the water removal system. Most condensate removal systems have a limited capacity. Their capacity is governed by the cooling coil they are used with. Now if a cooling coil normally has a capacity of 9,000 Btu's at one set of design conditions, say at a back pressure of 40 pounds, it may have a latent heat removal of 2,000 Btu's. This means that the cooling coil under these conditions will remove approximately 2 pounds of water each hour. (There are 1,080 Btu's absorbed for each pound of water removed from the air.)

Now if this same cooling coil is run at identical conditions but at a back pressure of 20 pounds, the coil will have a latent heat removal of about 6,000 Btu's and so it will remove approximately 6 pounds of water from the air each hour. In other words, the load imposed on the water removal system will be about 3 times greater than it would if the cooling coil were operated at the proper suction pressure.

When the water removal system is overtaxed in this manner, water from the condensate pan spills over on the floor and causes damage to rugs and floors. Or if the water removal system is equipped with a safety switch, the safety switch will shut off the cooling unit when the water level in the condensate pan rises to the danger level. This of course will happen on those days when cooling is required most and when the load on the system is great so that the customer becomes very dissatisfied.

Remedies for an Over-Capacity System

An over-capacity system can be made to work satisfactorily by one of the following methods:

1. Replace the refrigerating machine with one of the proper capacity.
2. Install a smaller pulley on the refrigerating machine motor and thus cut down the speed and therefore the capacity of the compressor.
3. Install an evaporator regulating valve at the suction side of the cooling coil and set this valve to operate at the design temperature of the cooling coil.
4. Install a larger water removal system to remove the condensate and wrap the suction lines with felt to prevent sweating.

All these methods are self-explanatory excepting item 3 which we will discuss further.

The Evaporator Regulating Valve

The evaporator regulating valve forms a restriction in the suction line which varies so as to maintain a constant pressure at the cooling coil when the refrigerating machine has a capacity greater than that required by the cooling coil. The evaporator regulating valve has a gage port located on the coil side of the valve.

To install the valve, break the suction line at the cooling coil and insert the valve in the suction line. Then install one gage on the valve and another gage on the crankcase valve of the compressor. Allow the machine to run about one-half hour with the same pressure showing on each gage. (In other words the evaporator regulating valve opened fully.) After this period of operation, adjust the valve until the gage on the valve reads the design pressure (usually between 30 and 40 pounds for F12 systems). When this is done you'll notice that the crankcase pressure is considerably less than the valve pressure. The crankcase pressure will vary as the load on the cooling machine varies, but the pressure at the valve will remain substantially constant over wide variations in the load.

Later articles will discuss troubles encountered with improperly sized refrigerant lines and the various troubles encountered with multiple systems where the number of cooling coils connected to the system varies over wide limits.

S S S

Joseph A. Pechi
Indiana

This is the best refrigeration service magazine I have read and looked at. I will pass on a good word to the other servicemen in our city about your magazine.

A. J. Carseldine
Australia

Let me congratulate you on putting out such a gold mine of information as THE REFRIGERATION SERVICE ENGINEER. I consider it to be an investment to anyone in the business. I shall never regret having decided to subscribe to it.

KNOWLEDGE is gained by reading. Reading is done in non-productive time. Read THE REFRIGERATION SERVICE ENGINEER.

Ninth Article — *Commercial R. I. Motors*

Electronics for Servicemen

Field Repair Service on Commercial R. I. Motors

By WALTER G. CHRISTIE, B.S.E.E.

SOME manufacturers use a horizontal commutator on their larger size R.I. motors. In this case the motor resembles a d.c. motor in that it has a horizontal commutator on which two or four brushes ride continuously. These motors work on the same electrical principles as do the smaller brush lifting type R.I. motors. They differ only in the manner in which the change from repulsion-start to induction-run is made.

This type motor has fewer moving parts than has the brush lifting type. Figure 1 shows how this motor is built.

The necklace for this motor is made of heavy copper bars strung together on a piece of wire as shown in Figure 2. This is wrapped around a circular steel disc and the necklace is held in place by an endless circular steel spring. The disc which holds this necklace assembly is then driven onto a spline on the armature shaft so that the necklace goes inside the commutator and only an edge of the necklace protrudes. The necklace spring keeps the necklace away from the commutator when the motor is at rest.

The steel brush holder is mounted on the end cover of the motor and the brushes are grounded to the motor frame just as they are in the brush lifting type motor. As in the brush lifting type motor, *there is no electrical connection between the armature and the fields.*

When power is applied to the field winding, current flows in the armature by transformer action as explained previously in this series. Then the armature starts to revolve. As the armature picks up speed, the heavy necklace bars tend to fly outward because of centrifugal force. But the necklace spring tends to hold them in. When the armature is up to about 900 r.p.m., the centrifugal force overcomes the restraining action of the necklace spring and the necklace bars fly outward until they hit the inside face of the commutator. When the necklace comes in contact with the commutator, the commutator is short-circuited, the armature becomes the electrical equivalent of the squirrel cage armature and the motor then runs as an induction motor.

The brushes on the commercial type R.I. motor ride on the commutator 100 percent of the time,—but they carry current only when the motor is starting. Once the motor is up to speed, all the armature current flows

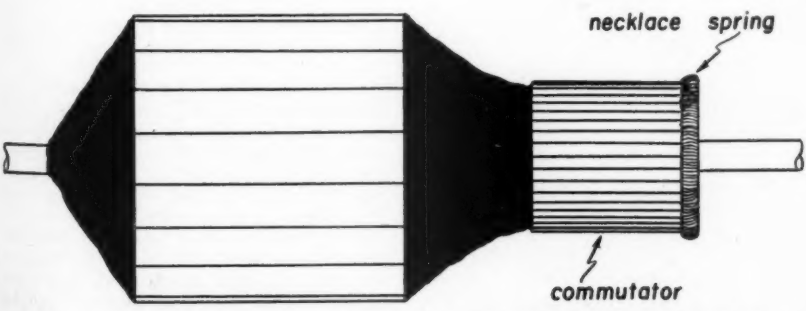


FIG. 1. ARMATURE FOR THE COMMERCIAL R.I. NON-BRUSH LIFTING TYPE MOTOR.

through the necklace. Thus when the motor is up to speed, the brushes can be lifted from the commutator and the motor will continue to run.

Troubles in Commercial R.I. Motors

Troubles encountered in the field with these motors are similar to these encountered with the brush lifting type of motor. These troubles may be enumerated as follows:

(1) Bearing trouble.
(2) Winding trouble, open circuits and short-circuits in armatures and fields.
(3) Starting mechanism trouble.

Since the first two of these troubles show up in the same way as in brush lifting motors and since repair procedure has been given in the previous articles of this series, these troubles will not be discussed here. Rather we will just discuss number 3.—Starting Mechanism Trouble.

Starting Mechanism Trouble

The starting mechanism includes:

(1) Commutator
(2) Brushes
(3) Necklace
(4) Necklace Spring

Since the brushes ride on the commutator 100 percent of the time, more trouble is experienced from the brushes on commercial R.I. motors than is experienced with brush lifting R.I. motors.

When brushes get worn, the motor sparks excessively at the start and when a motor is allowed to operate in this condition, the commutator gets badly burned and roughened.

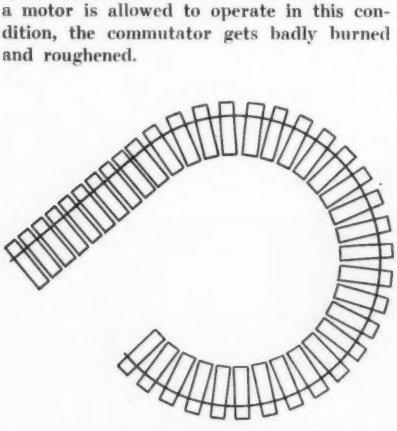


FIG. 2. R.I. MOTOR NECKLACE
Heavy Copper Bars held together by a steel wire

The rough commutator rapidly cuts away the brushes and soon they are too short to make contact, and the motor won't start.

When a motor is found in this condition, it is generally best to return it to the shop to true up the commutator in a lathe. However, the motor can often be restored to service by merely installing new brushes and refacing the commutator with a commutator dressing stone and some fine sandpaper.

To reface the commutator, slip off the belt and start the motor. Then firmly press the dressing stone to the commutator and keep moving the stone across the face to prevent cutting a ridge in it. When the commutator feels smooth to your finger, take the fine sandpaper and sand until it is silky smooth.

If after the commutator is cleaned, the brushes make a clackety-clack noise as they ride on the commutator, put your finger nail on one of the brushes while the motor is operating. If you feel a rapid vibration of the brush, the motor should be returned to the shop because the commutator is out of round and should be trued up before it is put back in service.

A Weak Necklace Spring

The necklace spring on commercial R.I. motors often becomes weak after a few years service and must be replaced, because a weak spring seriously affects the starting torque of the motor. This happens because when the spring is weak, the necklace bars fly outward and short-circuit the commutator before the motor is up to speed. Then the motor cannot continue to run as a repulsion motor and its speed drops off and the motor runs again on its brushes. This starting and stopping continues until the backpressure on the compressor drops sufficiently so that the motor can pick up speed even after the necklace short-circuits the commutator. Needless to say, this jerky motor operation harms both motor and compressor.

When a motor is found with a weak necklace spring, the spring should be replaced as soon as possible to prevent harming the motor or compressor. To replace the spring, first remove the motor end bell on the commutator end of the motor and then pry off the necklace spring with two screw drivers. Reverse the procedure when installing the new spring. *NOTE:* The motor need not be removed from the chassis to do this work provided that the motor end bell can be removed without removing the motor from

the complete refrigeration high-side.

Trouble Caused by a Dirty Necklace

Since the necklace in the commercial type R.I. motor is made of heavy copper bars, the necklace seldom burns out. However the necklace often becomes coated with oil and dust and this causes it to make poor contact with the commutator. Then the necklace will spark and cause the commutator to overheat. If a motor is allowed to run for a period with a dirty necklace, the commutator will get so hot that it will actually fly apart. When this happens, the motor must be rewound.

To test a motor for a bad necklace, quickly flip the switch on and off several times and watch for sparking at the necklace. If it sparks, the motor should be returned to the shop to have the necklace and commutator cleaned.

Since the necklace disc is driven onto the splined part of the armature shaft, the necklace cannot be removed easily in the field. Then too, in order to properly clean the necklace slot (inside of the commutator where the necklace makes contact), the armature must be set up in a lathe and a light cut taken off the inside of the commutator. When this is done, all traces of dirt are removed.

When the necklace is removed from the motor, it can be thoroughly cleaned by holding it against a scratch wheel until it shines like new copper.

Refrigeration Code for Chicago

A Revision of the Proposed Code as Submitted on January 20, 1936

THE newly revised refrigeration code for Chicago has recently been completed, and will soon be available to the readers of this journal in printed form from the office of THE REFRIGERATION SERVICE ENGINEER.

The new code is changed considerably over that published in 1936, in its scope and in its interpretation of the rules. The Department for the Inspection of Steam Boilers, Unfired Pressure Vessels and Cooling Plants is given, under the terms of the code, power to pass upon any question relative to the installation and operation of refrigeration systems. The Department also has the power of making or adopting any further rules interpreting or clarifying the requirements which are definitely prescribed.

It is the duty of the Department, under the provisions of the code, to inspect all refrigerating systems once each year, or more, if it is felt necessary to the protection of life and property. A permit and the Department's approval of plans is required before any owner or agent undertakes the installation or alteration of a refrigerating system. The Department will issue a certificate of inspection, which must be posted in a conspicuous place near the machine. No inspection is required on a unit or remote system of ⅓-hp. or less, containing not over six pounds of refrigerant.

All used equipment must be inspected by the Department before it is painted, and a certificate of inspection must be in the hands of the dealer before the apparatus is offered for sale.

The classification of systems and the fees for the first inspection are divided into two general groups: household multiple and remote systems in the first group, and commercial and industrial systems in the second. The first group is further divided into Class B, C and D systems, while the second group is divided into Class A, B and D systems. Permit and annual inspection fees are based on a graduating scale according to the size and refrigerant content of the system.

Considerable space is devoted to definitions of terms used, thus avoiding unnecessary confusion. Under this heading, gases are divided into two general classifications, and these into two sub-classifications. The first includes the non-irritant and non-flammable group, class one and two, and the second the flammable or irritant group, class one and two. The code then specifies where these various classes of refrigerant may be used, and in what quantity.

Further provisions in the code specify where machines may be located in various kinds of buildings; what kind and the strength of material to be used in refrigerant lines and hangers; how the system shall be constructed insofar as valves, mains, junction boxes, etc., are concerned; also, what safety devices are required and

how or where they must be installed.

Definite test pressures for each refrigerant used are set up with the provision that tests must be made in the presence of the inspector. Inert gases, such as air, carbon dioxide or nitrogen, are specified for the pressure testing of any system.

Full operating instructions, together with the name, address and telephone of the engineer or operator in charge, the service company and the Department for the Inspection of Steam Boilers, Unfired Pressure Vessels and Cooling Plants, must be posted in a conspicuous place near the compressing unit. A chart, showing the kind and amount of refrigerant added to the system at any time, must also be posted so that the amount of leakage can be determined for any period.

Penalties of not over $200.00 and not less than $25.00 are provided for violations of any of the provisions.

Kelvinator Evaporative Condensers

By O. C. CESSNA*

Principles

THE cooling effect necessary to condense a refrigerant gas to a liquid is accomplished by a combination of water and air movement over the surface of a fin type condenser coil through which the warm refrigerant gas flows. Water is distributed over the condenser surface, and a positive air movement through the unit produces evaporation of a portion of the water on the surface of the condenser thus using the latent heat of evaporation of the water on the condenser surface to absorb the necessary heat from the refrigerant gas to condense the gas to a liquid. This simple principle of evaporative cooling results in a saving of 90 to 95 percent of the cooling water required by a conventional water cooled condensing unit because the latent heat of one pound of water vaporized on the condenser absorbs approximately 1073 B.t.u.'s from the condenser gas whereas the same pound of water passing through a conventional water-cooled condenser would absorb only 15 to 25 B.t.u.'s to produce the same condensing temperature and condensing pressure.

Description

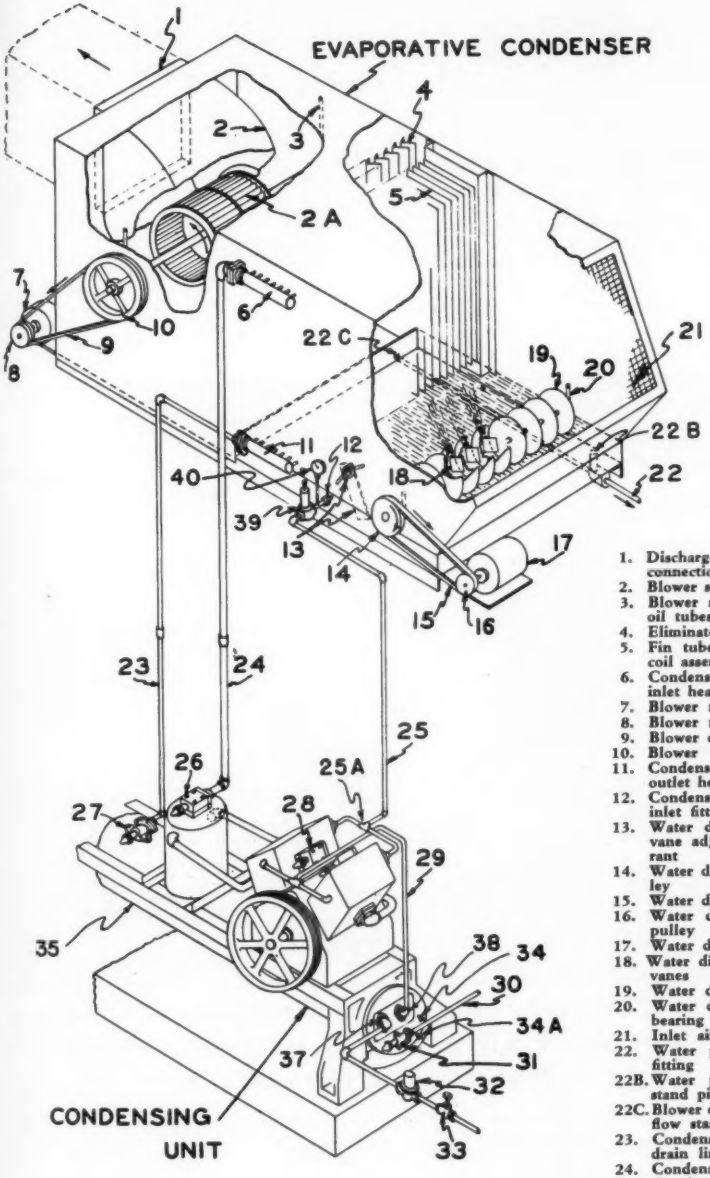
The Kelvinator evaporative condensing units consist of two major parts: the evaporative condensed assembly and the compressor unit assembly. The principal parts of both assemblies are illustrated in the schematic drawing Fig. 1. A brief description of the assemblies are as follows:

Evaporative Condenser Assembly

A copper fin and tube condenser coil (5) is located over a pan of water and placed within an enclosing case. This condenser is of special design with widely spaced fins to permit cleaning with a wire brush if necessary. The enclosing case is provided with a blower (2A) which draws outside air through inlet screen (21) and discharges the air to the outside through blower shroud (2) and discharge duct (1). The blower is driven by an electric motor (7) located at the front end of the assembly. Suitable oil tubes (3) are extended to the top of case to provide means of oiling the blower shaft bearings. Eliminator plates (4) are located between the condenser coil (5) and blower (2A) to prevent any free water that may be entrained in the air stream from entering the fan and return this free water to the water pan. Located near the air inlet screen (21) and directly over the water pan is a rotating shaft provided with brass disc (19). This disc shaft is located in such manner that the edge of the brass disc extends approximately three-quarters of an inch into the water. Located over the leading edge of each brass disc is a water guide vane (18). These guide vanes are attached to an adjustable bar which is extended to quadrant (13). This quadrant (13) provides means of adjusting the angle of water spray from the water disc. The disc shaft bearings are located inside the enclosing case and are completely shielded from the water spray. Suitable oil tubes (20) are extended to slots in the side of the enclosing case to provide means of oiling the disc shaft. The disc shaft is driven by the electric motor (17) located on the rear frame of the as-

(Continued on Page 34)

* Engineering Division of Nash-Kelvinator Corp.



1. Discharge air duct connection
2. Blower scroll
3. Blower shaft bearing oil tubes
4. Eliminator plates
5. Fin tube condenser coil assembly
6. Condenser coil gas inlet header
7. Blower motor
8. Blower motor pulley
9. Blower drive belt
10. Blower shaft pulley
11. Condenser coil liquid outlet header
12. Condenser water pan inlet fitting
13. Water disc guide vane adjusting quadrant
14. Water disc shaft pulley
15. Water disc drive belt
16. Water disc motor pulley
17. Water disc motor
18. Water disc guide vanes
19. Water disc
20. Water disc shaft bearing oil tube
21. Inlet air screen
22. Water pan overflow fitting
22B. Water pan overflow stand pipe
22C. Blower drip pan overflow stand pipe
23. Condenser liquid drain line
24. Condenser gas line
25. Condenser water inlet line

FIG. 1. DRAWING OF A CUT-AWAY VIEW OF KELVINATOR EVAPORATIVE CONDENSER.

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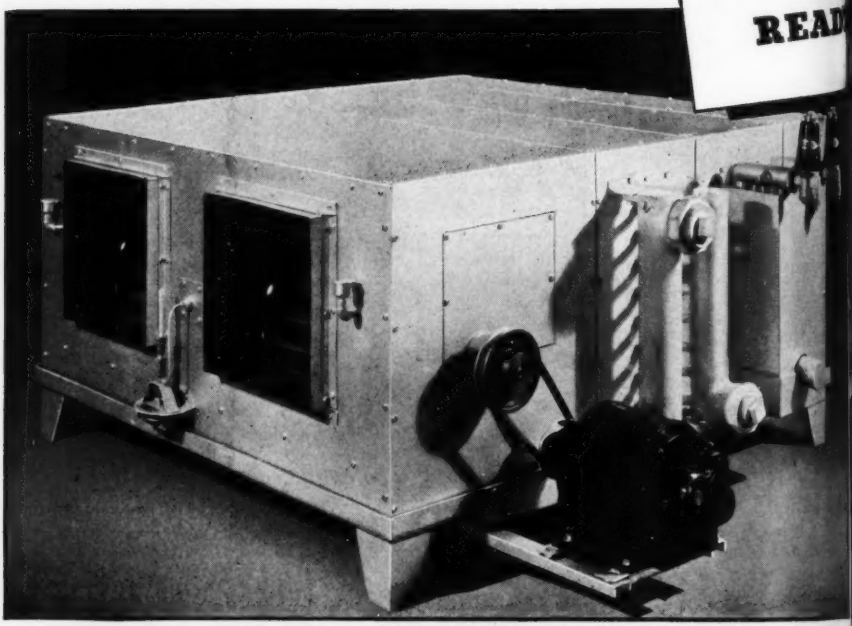

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...edders high efficiency ALL COPPER cooling and heating ...oils designed for correct distribution of refrigerant, cold ...ater, steam or hot water.

...ompact manifolding minimizes space requirements.

...edders High Capacity Thermostatic Expansion Valves ac...essibly located on exterior for easy adjustment.

...omplete accessibility to entire interior of cabinet through ...emovable panels gives quick access to filters, coils, humidi...ers and blowers.

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...Rustproofed construction throughout.

...Light, rigid frame reinforces entire unit . . . maintains ...alignment.

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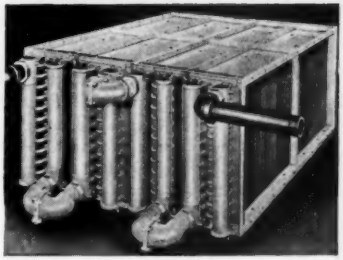

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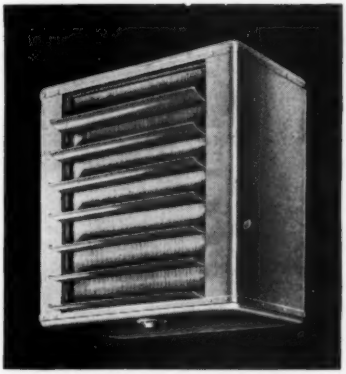

Fedders Series 73 Unit Coolers

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FEDDERS MANUFACTURING CO.
BUFFALO, N. Y.

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KELVINATOR EVAPORATIVE CONDENSERS

(Continued from Page 30)

sembly. The condenser coil (5) is provided with a gas inlet header (6) which is connected to the discharge service valve (26) located on the oil separator. The liquid outlet header (11) is connected to the receiver inlet service valve (27) located on top of the liquid receiver. The water pan is provided with a water connection (12) located on the header side of the assembly; this inlet water connection is connected to the cylinder head outlet water connection (25A). The water pan is provided with overflow connection (22). A threaded standpipe (22B) extends from the overflow fitting into the water pan to maintain the proper water level in the water pan, and any surplus water can overflow through this standpipe. This standpipe (22B) can be removed to provide means of draining the water pan. A drip pan is provided under the blower assembly to catch any condensation or free water that may accumulate past the eliminator plates (4). This drip pan is provided with drain outlet (22C) which is connected to an opening provided in one end of overflow fitting (22). Overflow fitting (22) is tapped for standard pipe thread and the overflow pipe from this opening must always be full size and have sufficient slope to drain properly.

Compressor Unit Assembly

The assembly consists of the conventional electric motor, compressor, oil separator, oil return float and drive mounted upon a frame assembly. Built into this frame assembly is a special horizontal liquid receiver. This liquid receiver replaced the conventional condenser receiver assembly as used on the standard water-cooled condensing units. Built into the bottom of this special receiver is a certain length of copper tubing. This copper tubing is known as the liquid sub-cooling coil; one end of this tube is extended to water inlet connection (37) located on the end of the receiver. The make-up water for the condenser pan enters the inlet fitting (37), passes through the liquid sub-cooling coil in the receiver out through fitting (38) through connecting pipe (29) into cylinder jacket, out of cylinder jacket to cylinder head, then out of cylinder head through fitting (25A) and connecting pipe (25) to water pan inlet fitting (12).

Air Requirements

Since the air passing over the condenser coils absorbs the total heat given off by the condenser, provisions must be made to conduct outside air at normal heat content to the condenser inlet and conduct the heat laden air discharged from the condenser to the outside air in such manner that it will not short circuit and again enter the condenser. When the condenser assembly is located inside of a room or enclosure a discharge duct must be installed from the condenser outlet (1) to the outside air. Opening must be provided into this room of sufficient size to permit entry of the required amount of air. When such opening cannot be left permanently open or where the large quantity of outside air drain into the room would be objectionable, an inlet duct must be installed to conduct the inlet air to inlet screen (21) at rear of condenser assembly.

Water Requirements

Since most of the cooling effect of this type condenser is produced by using the latent heat of evaporation of the water in place of the sensible heat rise or temperature rise on the conventional water-cooled condenser, the water required is small as compared to a standard water-cooled condensing unit. The actual quantity of water evaporated on the surface of the condenser will vary considerably during a given day of operation. This quantity of water will vary as the total heat input in B.t.u.'s into the condenser, and the total heat content of the air entering the condenser, and the relation of its latent heat to total heat content.

Make Up Water Control

On conventional evaporative condensers and cooling towers it has been common practice to use the float valve control to maintain a constant level in the condenser pan to supply the variable quantity of water vaporized. On systems using a float valve mechanism only the actual water vaporized is added to the pan. This practice soon results in concentration of any grains of hardness in the pan and rapidly coats the condenser surface with scale. Due to this characteristic and other erratic actions of floats, Kelvinator does not recommend the use of a float control.

Kelvinator recommends a definite quantity of water for each model. This quantity is slightly in excess of the actual maximum requirement in order to continually dilute the water in the pan, thus eliminating the concentration of hardness and scaling of the condenser surface. The water flow to the condenser pan is started and stopped by a water solenoid valve electrically connected

to the condensing unit motor in such manner that the valve is open when the condensing unit is in operation and closed when the condensing unit is idle. The flow is regulated by a pressure reducing valve located near the pan water inlet fitting.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box." The following questions are answered by Mr. George H. Clark.

G. E. SERVICE

Question 218. I have under inspection and observation a G.E. Type F-4-A 3, which has the G.E. J. compressor in the base, as usual for this model, with a rotary compressor belt driven, high-side float with a U-shaped freezing unit.

The above machine was used about three months and operated OK. It was idle for about six months, and then put back into operation, but failed to freeze. After charging it with gas to a point where it frosted the suction line a short distance from the receiver (which is usually the right indication of the proper amount) the whole machine operated perfectly in every respect with the exception of a noise like oil pumping that is usual on a rotary compressor, and continued so after allowing a three-day run of normal cycle for redistribution of oil.

Please advise just what you think may be the trouble.

Answer: Since the refrigerating machine which you describe apparently lost its refrigerant during the time it was stored it is possible also that it may have lost part of its oil or it is further possible that air may have been drawn into the system where the refrigerant leaked out so that the head pressure on the machine is much higher than normal. In all probability the noise has some relation to the way in which the oil is circulating through the compressor.

OVERHAULING COMPRESSORS

Question 219. Would appreciate your suggestions on cleaning and overhauling compressors and receiving tanks on electric refrigerators. I do a lot of service work, but have no equipment to overhaul and dehydrate a compressor or tank. Do you have in mind any inexpensive set-up or method of doing this? I would not have over three to four of these jobs in a year's time, and cannot afford expensive equipment.

Answer: In overhauling compressors a fairly good job can be done by cleaning them out thoroughly and wiping all parts clean and dry and then recharging with fresh refrigeration oil. These may then be heated for some period of time by means of torches, at the same time a vacuum is drawn on the compressor.

Receiving tanks may be washed out quite thoroughly with carbon tetrachloride or gasoline. In order to remove any carbon deposits Xyolene works out very well. One method is to completely empty the receiving tank and draw a vacuum on the tank by means of an auxiliary compressor and use the vacuum to draw in the cleaning fluid after which the tank may be thoroughly shaken around so as to rinse out the inside. A good air pressure may be applied to the tank which is then used to blow the cleaning fluid out. After this the tank should be warmed in some manner while maintaining a good vacuum on it in order to remove all traces of the cleaning fluid and to insure absolute dryness.

RATE OF HEAT TRANSFER FOR PIPE

Question 220. Can you supply me with, or advise me where I can find a complete table or formulas for determining the B.t.u. transfer rate of bare pipe and tube, both copper and iron, of various diameters and under varying room and gas temperature conditions?

Also would like information as to transfer rate when tubing is submerged in water, as compared to air.

This information would be of assistance in computing coil sizes and lengths needed in many jobs.

ANSWER: The rate of heat transfer from air to bare pipes or tubes usually varies from one B.t.u. to three B.t.u. per square foot of tube surface per degree temperature difference, between the refrigerant and air per hour depending upon where the bare tube coil is located as to how it affects the rate of air circulation over the coil. If the tubes are located in an open space we may depend upon the heat transfer of two B.t.u. per square foot per degree temperature difference per hour. To put this in formula form it may be written as follows:

B.t.u. per hr. for a bare tube in open air equal $.52 \times D \times L \times T.D.$

where D is the diameter of the tube in inches; L is the length of the tube in feet; and T. D. is the temperature difference between the evaporating refrigerant and the air. The heat transfer from bare tubes to water which is not agitated but has normal convection circulation by the tube is approximately five times the heat transfer from the air to the refrigerant so that the heat transfer in this case may be written as follows:

B.t.u. per hr. for a submerged tube equal $2.6 \times D \times L \times T.D.$

where D equals diameter of the tube in inches; L equals length of the tube in feet; and T. D. equals the temperature difference between the evaporating refrigerant and the water.

CORROSION ON BLOCK TIN TUBING

QUESTION 221. What can be done if a powdery substance forms on the block tin tubing in a sweet water bath for beer cooling? Black spots appear and it eventually leaks in a month or six weeks.

ANSWER: I have not had any particular difficulties of the nature mentioned brought to my attention, although I do know there is always considerable difficulty in keeping the coil clean on the inside. There is also some difficulty in leakage occurring in this tube.

I would think that the indications are that there is something in the water or else that the tin is not as pure as it might be. If there are some foreign substances or some other metal imbedded in the tin, it may be that some electrolytic action might be set up which would tend to cause corrosion where the two metals are in close contact with each other.

My suggestion would be that you use a copper tube tinned internally and externally and I believe that you may be able to get away from the conditions mentioned.

FIGURING A PASTEURIZING JOB

QUESTION 222. I have a pasteurizer which holds 100 gallons of milk and which makes it necessary for me to pasteurize twice to get my required 200 gallons. At present, the milk is cooled by ice, but I am considering installing a Frigidaire.

Could you advise me as to what size unit is needed, how large the tank, the number of gallons brine required, the kind of coils needed, and the kind of tank required? Also, the most desirable kind of insulation since the outfit will be placed in an open garage.

ANSWER: Since you say you are going to have 200 gallons of milk to pasteurize and I presume you are going to have this quantity twice a day, you will have to chill this milk from your highest temperature to your lowest temperature in batches of 100 gallons each; and two of these batches would come so close together that we may consider that the brine tank or cold storage tank must have sufficient capacity to take care of the 200 gallons.

The 200 gallons of milk will weigh approximately 1600 pounds and I presume that you will depend upon refrigeration for cooling this milk through a temperature difference of about 30 degrees; that is, it would be more economical to use well water or any other cold water supply available to cool the milk from your warm milk tank to a temperature of 60 degrees to 70 degrees. The temperature can be lowered from this temperature to about 40 degrees by means of an aerator which is cooled by brine.

In order to cool 1600 pounds of milk 30 degrees you would have to remove approximately 48,000 B.t.u. In all probability you will not want your machine to operate more than six hours to provide this amount of cooling, which will give a cooling requirement of 8,000 B.t.u. per hour while the machine is in operation. A one-horsepower water-cooled refrigerator machine should give you a capacity of 8,000 B.t.u. per hour with an evaporation temperature of approximately 5 degrees to 10 degrees.

If you plan on using a non-freezing brine to maintain your refrigeration while you are not operating your milk cooler, I would suggest that you plan on not more than 16 degrees temperature change in your brine so that with 48,000 B.t.u. you would have to

have approximately 3,000 pounds of water contained in the brine with the proper amount of salt added.

I would suggest that a tank of about 60 cubic feet be used for brine storage. This size tank could be arranged to be 3 x 4 x 5 feet. A refrigerating coil consisting 100 feet of ⅝ in. copper tubing should be used.

The tank may be made from sheet iron and it may tend to resist corrosion somewhat if it is painted on the inside with a good weather-proofing paint.

An outlet from the lower part of the tank could be connected to a brine circulating pump. The brine circulating pump may be of the centrifugal type and probably a one-quarter horsepower size will take care of the job nicely.

The pipes should be insulated so as to prevent loss of refrigeration to and from the aerator itself.

I would suggest that for a garage installation a suitable wooden box be built and that about three or four inches of corkboard be placed in the bottom after which the tank could be set on the corkboard and piping connections made through the box after which the space between the box and the tank may be filled in with granulated cork or rockwool or any of the other good insulating materials and that a wooden top may be provided for the tank lined with approximately one or two inches of corkboard.

If the size of brine tank were an item and if the variation in temperature of the brine going through the aerator and, therefore, the temperature of the milk leaving the aerator is objectionable, I would suggest that a smaller tank might be used, using a eutectic freezing solution as the holdover agent as suggested in an article in the REFRIGERATION SERVICE ENGINEER about six months ago.

CONDENSERS FOR CAPACITOR TYPE MOTORS

QUESTION 223. We would like to know if there is some rule that we can go by in figuring the capacity needed on capacitor types of motors. We have tried to get this information, but so far have been unable to. At the present time, we have a Delco motor Model 6230, Serial D-2-3, Phase 1, 110-volt, 60-cycle, 3.6 amps., 15-hp., 1730 r.p.m., on which we need a capacitor and would like to know how to arrive at the capacity needed.

ANSWER: I do not know how you might arrive at the capacity of the condenser needed on the various types of capacitor motors other than by determining the capacity from the various manufacturers or in measuring the capacity of a condenser supplied with a model of motor in which you are interested.

Some of these motors make use of the condenser in series with the starting coil only and the condenser is cut out when the motor gets up its speed. In some cases a transformer is used to step up the voltage connected through the condenser and the starting coil, in which case the condenser capacity need not be as great as when no transformer is used.

In order to measure the capacity of the condenser it is usually necessary to have a condenser of known capacity to use as a standard and the other condensers may be calibrated from the known standard.

The method of measuring it involves something of a technical test and the ordinary shop is usually not provided with the equipment necessary. In case you are interested in a method of making such tests, I should be glad to give you such a method.

AIR-CONDITIONING A GLASS HOUSE

QUESTION 224. We would like to know the proper kind of motor, machinery, or whatever you wish to call it, to air-condition a glass house.

What we want to do is maintain a temperature of approximately 65 degrees inside the place. The temperature outside usually runs anywhere from 90 degrees to 105 degrees.

The space to be air-conditioned is 27 feet long, 14 feet wide, and about 9 feet high. This place is a glass house used for keeping delicate plants; therefore, the temperature must be kept fairly even without too much air stirring. Could a humidity control be installed, and what would be the proper type of unit for such a place?

The man who wants this air-conditioning has in mind what we call a Desert Cooler. We are enclosing a pamphlet of this cooler in case you are not familiar with it. We do not believe it would be the proper thing for this purpose. Can you tell us what would be the best kind of thing for him to use?

We would appreciate any help or suggestions that you could give us.

ANSWER: The first problem in determining the size of air-conditioning equipment for the glass house which you inquire about would consist in determining the heat load.

The principal heat load is going to be

heat leakage through the glass due to the difference in temperature and due to the exposure to the sun. From your sketch I should say that you have two sides having a glass area of approximately 12 x 25 feet and two roof sections having an area of 9½ x 27 feet; and in addition there is an extra glass area on one end which may consist of approximately 150 square feet, so that as near as I get the picture, the total glass area is 1392 square feet, or we may say approximately 1400 square feet.

Due to heat leakage through these glass walls we can find our leakage load by taking a factor of 1.1 as the heat transmission in B.t.u. per square foot per degree temperature difference per hour for a single thickness of glass.

If we are to maintain an inside temperature of 65 degrees with 100 degrees outside, we will have a 35 degree temperature difference and our heat leakage then will be 1400 x 35 x 1.1 equals 53,900 B.t.u. per hour.

Additional Load Due to Sun

Due to sun exposure on the glass, we can add an extra heat input of one B.t.u. per square foot of glass area per degree temperature difference per hour taking into account the amount of surface which may be exposed to the sun at one time. Not knowing what direction your building is facing, I presume that the sun may be shining on both roof sections and one side at one time. We may consider our whole glass area to give us a rough approximation and say that the glass which is unexposed to the sun will compensate for other heat load through the closed end and cement foundations which we shall not consider otherwise; so that due to sun exposure we can take our extra heat input as being 1400 x 35 equal 49,000 B.t.u. Thus the total load on the cooling equipment will be about 102,900 B.t.u. or slightly less than nine tons of refrigeration.

You did not specify what humidity you want to keep, but I imagine that the relative humidity might be kept high enough if refrigerating coils were used and maintained at a high temperature of approximately 50 degrees. If the coils were maintained at a temperature much below 50 degrees, probably too much dehumidification might occur.

I believe that blower-type coils might be used if located very near the top of the glass house. The air circulation while somewhat rapid from the blower-type coils would not be very rapid when the air had settled down to the level of the plants. The desired conditions might be obtained also by locating a washer or scrubber type of cooling cabinet on the outside of the house and circulating the air from this cabinet through the end of the house into the inside providing a low velocity air circulation.

The advantage of the washer or scrubber type of cooling unit is that the relative humidity may be controlled very nicely by raising the water temperature to the scrubber cabinet to increase relative humidity and lowering the water temperature to decrease the relative humidity.

Desert Cooler Not Suitable

The Desert Cooler of which you inclose a pamphlet would do an appreciable amount of cooling, but it is doubtful if you could produce a temperature anywhere near as low as 65 degrees. The air temperature leaving a cooler of this kind could not possibly be lower than the wet bulb temperature of the entering air and it seems to me that with the temperature conditions you have indicated that your wet bulb temperature is apt to be considerably above 65 degrees. If mechanical refrigeration were to be used with any type coils where the refrigerating temperature was to be maintained at 50 degrees or higher, you could get your nine tons of refrigeration quite readily with a seven and one-half horsepower condensing unit.

I do not know whether this information will be of much help as the whole set-up is not any too clear, but my first thought on the matter is that a water spray cabinet or air washer or scrubber as they may be variously called would be the most suitable apparatus for cooling the air supplied to the glass house. It would be necessary, of course, to use a cooling machine of some kind to provide the water for the scrubber cabinet at the proper temperatures. If you could get a sufficient quantity of water from a well at a temperature of from 50 degrees to 55 degrees, that would undoubtedly be the cheapest method of taking care of the job.

CHARLES A. SMITH
Maine

Enclosed is money order for $2.00 to cover my renewal subscription to The Refrigeration Service Engineer for one year. It has proven exceedingly helpful in my refrigeration service work.

Servicing the McClellan Refrigeration Unit

History, Description, Data and Service of One of the First Popular Ammonia Units. Many of These Units Are Still Operating and Are in Need of Service or Overhauling

By L. K. WRIGHT, M. E.

IN 1916, a locomotive engineer, Benjamin McClellan, organized a company using his name to manufacture an ammonia refrigeration unit designed and patented by him. Organized under Illinois laws, the company established their shops at 504 West Adams Street, in Chicago. A reorganization was effected in 1918 and the business moved to Roosevelt Road and Washtenaw Avenue, Chicago, Illinois. About 1923 the shop was moved to 72 West Adams Street in Chicago.

In 1924 the stock, machinery and equipment was moved to East Chicago, Ind., occupying quarters with the Edwards Valve & Mfg. Company at 1200 145th Street, East Chicago, Ind.

A few years later the McClellan organization discontinued business, transferring all mechanical parts to the Edwards Valve & Mfg. Company, of whom replacement parts were obtainable.

Design of Machine

The McClellan machine was one of the first, if not the first, to mount the entire high side on a prepared base, introducing the "unit" type of system. Previous to the advent of this unit, commercial machines were shipped in individual parts and erectors prepared concrete or wood bases for the assembly of the equipment, the general layout of each installation depending upon the available space.

An innovation in condenser design for small machines of its day was the shell and coil type employed in McClellan machines. In the smaller, fractional tonnage machines, the shell acted as a combination condenser and receiver. The larger sizes were provided with separate condenser and receiver vessels, both mounted vertically and placed side by side in the later models. The first models mounted the condensers vertically and had the receivers slung horizontally underneath the bases, out of sight. See Fig. 1, which indicates the early models.

The first bases for the larger sizes were of channel iron and sheet steel plates, while the later models made use of cast iron bases. All small models used cast iron bases.

This organization enjoyed considerable success until about 1922, when it brought out a four ton unit, the largest of the line. About a year or so after the production of this model the company appeared to lose its foothold in the industry. This model was really two of the single cylinder, two ton compressors assembled on a two-throw crankshaft, with a spool casting connecting the two crankcases. All models were of single cylinder, water-cooled head type.

Type of Apparatus

McClellan units at one time enjoyed a very wide sale and many units will be found in operation all over the country, more especially in the Middle West and in the vicinity of large cities. This product was really the first compact, semi-automatic, commercial machine of the unit type, for, with the first models, it was only necessary to open a water valve or to close it in order to cause the unit to start or stop.

The apparatus was of course water-cooled, ammonia being employed as the refrigerant. In the event of water failure, the water valve switch would prevent the unit from operating and developing excessive or destructive head pressures. It formed a simple control and acted as a very efficient safety device.

The water switch, mounted in the center of the base between motor and compressor, embodied a rubber diaphragm of rather large size, so that when the water valve was opened and water from the main was admitted to the apparatus and switch, the pressure would expand the rubber diaphragm and actuate the main electric switch.

Switch Action

The water switch should act smoothly

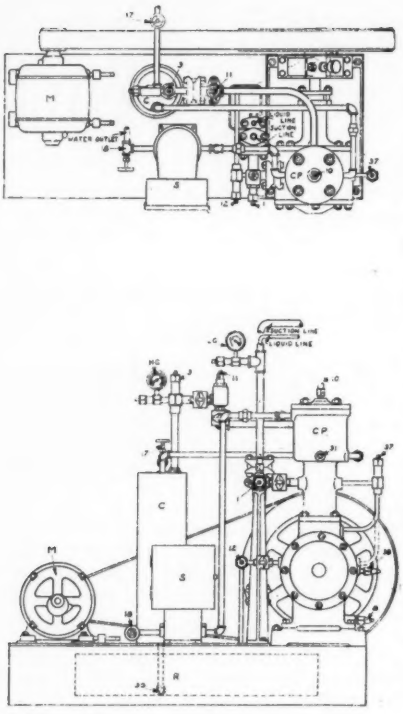

FIG. 1. EARLY MODEL UNIT.

and snap the electric switch open or closed. If the diaphragm becomes cracked or leaky it should be replaced and the switch adjusted for quick action; otherwise the contacts are liable to arc and burn. For replacement purposes use any good grade of rubber sheeting with fabric reinforcement.

Later (about 1920) the units were made entirely automatic by the use of a thermostat and a control relay, so that the units would stop and start automatically by fluctuations in box temperatures. These thermostats were attached to the side walls of the boxes and were not in contact with the evaporator coils.

The first units made use of a receiver mounted underneath the iron base, whereas the later models utilized an upright receiver, standing at the side of the vertical condenser vessel.

In some models an ammonia purge was located in the center of the head plate on top of the compressor. Models so equipped could be bled of ammonia or air by means of these purge valves.

Other models used an inner head plate over the cylinder and an outer or water head over the compressor. Such models allowed water to flow directly over the inner head plate. These models were not provided with ammonia purges in the head.

Valves

The older models were equipped with very heavy discharge valves, weighing several pounds, which were somewhat noisy in service, although not objectionably so. Later, a flat steel disc was used to replace the older, heavier type. These were quiet in operation but were not as reliable and occasionally required servicing or replacement. See Fig. 2 for valve data.

A check valve of the ball type, loaded with a heavy steel spring was used in the older models. Sometimes these check valves would "sing," sending out a distinct high pitched note. Where this noise was objectionable the ball and spring were pulled out for inspection. If the ball and seat were found to be perfect, the check valve would be reassembled, using a lighter steel spring. If the seat, or more rarely the ball, was found scratched, a perfect seat was first secured and a new ball installed. The old ball was usually used to grind in the seat and then discarded. Sometimes where the ball tended to lift to one side it would be found to be eroded. In some cases servicemen would grind off a turn or two from the original spring and then replace it, to cure a noisy check valve.

Garlock gaskets were used for inner and outer heads, as well as for cylinder base work, while sheet lead was used for all flange purposes.

Pipe and Connections

Litharge and glycerine was used on all pipe threads. Extra heavy black steel tubing of ¼ inch pipe size was used on all models for liquid lines with the exception of the four-ton unit, which used ⅜ inch extra heavy black steel tubing. For suction lines ½ inch extra heavy black steel pipe was used for the 1/7 and ¼ ton units, while ¾ and one inch extra heavy black steel pipe was employed for the one and two ton jobs. Extra heavy black steel pipe of 1¼ inch pipe size was used for the suction line of the four-ton unit. All connections between coils in the refrigerators were of

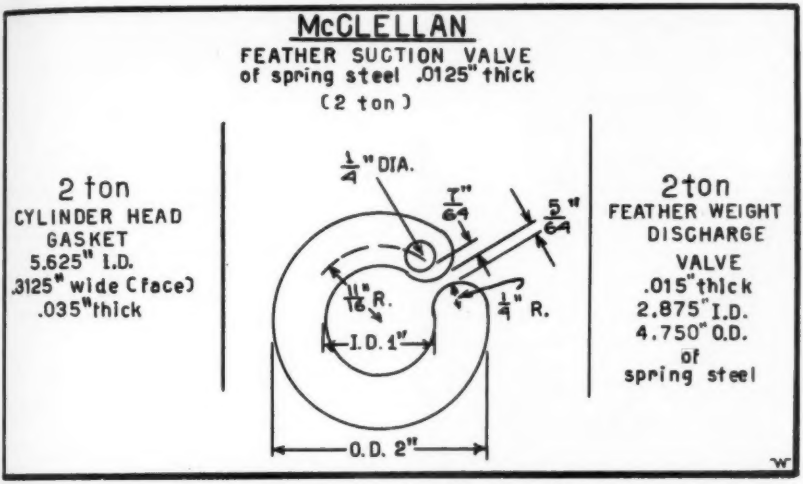

FIG. 2. The Serviceman Can Cut a Temporary Valve Out of Sheet Steel to These Dimensions

extra heavy galvanized steel pipe.

All connections were of the flanged type. The small steel valves employed on the units were not provided with valve or hand wheels, so that the serviceman had to make use of a key or valve wheel to open or close the valves.

Installers of McClellan apparatus employed screw fittings wherever possible and use flanged fittings for the final joining with other pipes or apparatus. All fittings were drop forged steel and were never known to give any trouble through porosity or structural failure. Servicemen, or those who are obliged to reinstall a job after moving it to another location, are cautioned to employ the drop forged fitting, for although it is more expensive its high first cost is offset by freedom from leaks, for which the cast-iron type is notorious.

Data on Units

The first units to be manufactured were 1/7, ¼, ½, 1, 1½ and two tons in capacity. All of the models were single cylinder compressor designs, mounted upon sheet and angle iron or cast-iron bases. Later, about 1922, two of the single cylinder two-ton models were fastened together to form a four-ton unit. The first of these units gave but little trouble, but with the newer designs, changes in valve construction and later the four-ton models, appeared to give trouble.

A sketch of the suction valve employed on some of the later models is shown in the cut, (Fig. 2) so that any serviceman can cut a duplicate if such a valve is found defective. While spring steel was employed for these valves it is possible for the serviceman to fashion a temporary one of any ordinary sheet steel until one of the proper steel can be secured. One such temporary valve, made of a piece of sheet steel, operated almost continuously for several weeks without the least trouble.

Cooling Coils

As a general rule all evaporators were constructed of extra heavy steel pipe and were galvanized upon completion of assembly. These coils were made of helically wound pipe, provided with three strap iron retaining strips and were usually suspended from the ceiling on through hooks or hung on wooden cross-members erected inside the box.

Special decks and baffles were employed, so that a definite path was taken by air currents. A refrigerator of the iced type to be equipped with mechanical refrigeration would be completely cleaned out, all old decks and ice racks being removed. Then the coil supports would be installed, baffles set into place, coils hung, and finally, the decks raised into place. Drip pans were placed on the sloping decks to catch the drip. An illustration (Fig. 3) of a typical installation is shown, so that the coils, decks and general assembly may be observed.

The four-ton unit was the largest of the McClellan line and was produced in 1922. It consisted of two regular two-ton, single

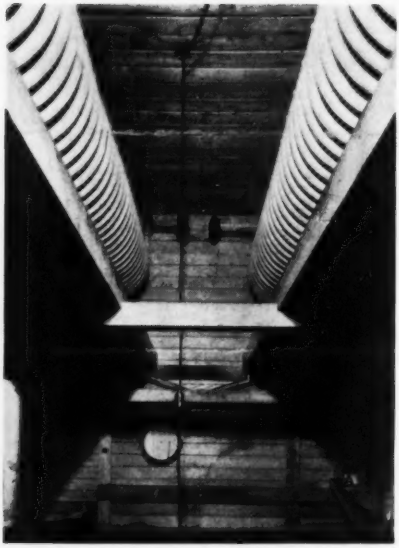

FIG. 3. SHOWING COIL AND DECK ARRANGEMENT

cylinder compressors joined together by means of a spool piece and made use of a two-throw crankshaft to operate the piston in each separate cylinder. Reference to the illustrations which follow will serve to clarify the construction and assembly of this model. See Fig. 4.

The No. 92 machine, as the four-ton was listed, consisted of two sections—one base holding the compressor, condenser and receiver, while the other base was used to mount the motor.

All of the other McClellan units were of the self-contained type, all high side apparatus being mounted on one base. The four ton unit alone required concrete foundations. A template was laid over each site (motor and compressor) before pouring the concrete, to make certain that the anchors for each base were in proper alignment. A one inch pipe sleeve was generally slipped over 5/8 inch anchor bolts to provide a little clearance or shift for the bolts.

No idler was employed on this large unit and it was necessary to operate with a fairly tight belt, for the drive was short, being six feet on shaft centers. Fig. 4 referring to this unit gives the layouts for bases and may be used to reinstall or move this unit from one location to another. Where space permits, it is advisable to increase the distance between shaft centers. It will be found that the use of a somewhat greater distance between shaft centers—say eight feet, will permit operation with less belt wear.

The suction line was brought back to the unit and then split off into two lines, one for each compressor. The individual suction openings would be ideal for certain installations, such as where there was a high temperature coil and a low temperature one, for each coil could be piped to its own compressor and each unit held at its own back pressure. This is one type of compressor which could use two automatic constant pressure expansion valves, each operating at its own and at different pressures. Servicemen who buy up such units or reinstall them in new locations for the owners should bear this possibility in mind.

The compressor discharge out of each compressor was teed into a cross valve, which was located on top of the condenser cylinder. In this type, water entered the condenser vessel at the bottom, issued out of the top and then passed first through one compressor jacket to the second jacket, thence to the jacket around the shaft seal and finally to the sewer connection.

The water-cooled shaft section had been used on some of the two-ton models. Where units were located in cold sections the drain plugs were usually replaced with regular drain cocks for convenience in draining. All drain ports must be opened in order to drain the various sections. If only one or two were opened incomplete evacuation would result, with the possibility of bursting some sections if freezing occurred.

The McClellan Refrigerating System

The entire system was assembled in the McClellan plant and shipped as completely assembled as possible. The machine was shipped as a unit, bolted to skids and enclosed within a protective crate. The coils, decks, baffles, drip pans, pipe, tubing, fittings, calcium chloride for brine, brine tanks, ammonia and cork covering were shipped to the location in one shipment, so that the installers could proceed and complete the installation in as short a time as possible. In many cases it was but a matter of hours that the refrigerator was transferred from ice to mechanical refrigeration, for first the unit would be set up in its proper location, electric lines installed, water lines brought to the unit and the ammonia lines carried to the refrigerator, before the old ice decks in the box would be dismantled and removed. Decks and baffles were made

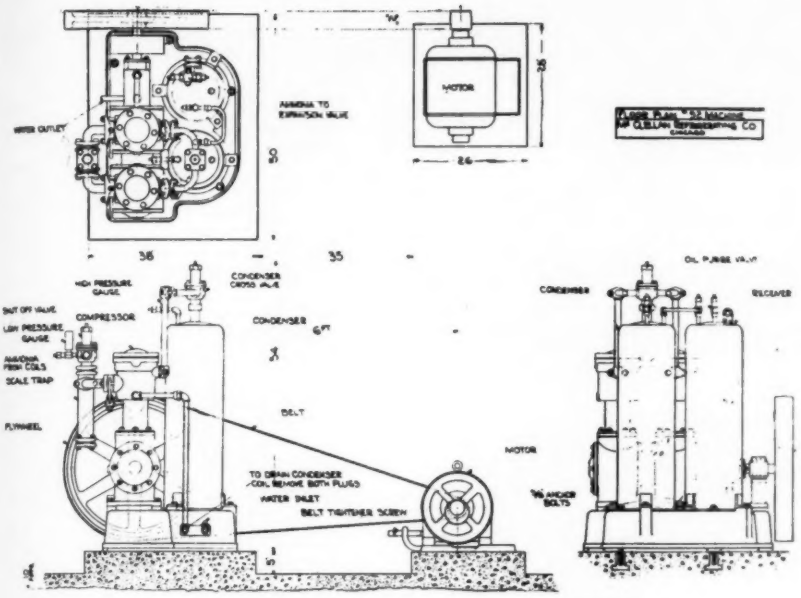

FIG. 4. GENERAL LAYOUT OF MODEL 92 MACHINE

to exact size and shipped so that they could be slipped into place without altering. Coils were of course proportioned and in many cases the installers would cut the pieces of pipe which were to join the coils and apply the fittings prior to setting the coils in place.

Shop Tests

The refrigerating machine unit consisted of a compressor (CP), belted to a motor (M), controlled by a water switch (S), and a condenser (C) and a receiver (R); all of which may be identified and located by reference to Figs. 5, 6 and 7.

The compressor valves were tested in the shop to hold at a pressure of 250 pounds per square inch. The cylinder walls were tested to hold against leakage into the water jackets at a pressure of 300 pounds per square inch; the bearings accurately aligned and the stuffing boxes packed and tested. Crane packing was used in most models for sealing the shaft.

Condenser, receiver and expansion coils were tested to withstand a pressure of 400 pounds per square inch. The water switch was adjusted to operate on a pressure of five pounds per square inch or more. The well in the compressor crankcase was filled to the proper height with the correct oil.

Instructions on the Installation and Testing of a McClellan Refrigerating System

Machine Location

Before a job was estimated the salesman had to provide a sketch of the layout, giving the dimensions, condition, insulation and load of the refrigerator, as well as all doors, passages, etc. The owner was consulted in regard to the location of the machine unit. Where a choice of several locations was had the machine would be placed as near as possible to the refrigerator, or brine tank, to minimize the length of the piping connections. All connecting lines between refrigerators had to be cork covered and these lines were run as direct as possible, for considerable expense was involved in providing cork covering for these lines. All boxes and their coils were in series, as a single diaphragm type of automatic expansion valve was used as a throttle device.

A firm timber or better still a concrete foundation should be provided and same should be free from vibration. Many units were installed in basements in which there was no concrete floor and the units placed directly upon the earth. Such units would move and eventually result in leaky lines.

Where the units were located upon floors above street level it was usual to use long timber bearers (usually 4 inches by 6 inches) which would extend over as many floor beams as possible, to eliminate the possibility of vibration. Many local ordinances of recent date prohibit the installation of ammonia apparatus above the street level.

Water Connections and Valves

The water inlet valve (17) was installed as near the condenser as possible, in a convenient place for easy manipulation, for this was the valve used to start and stop the apparatus. In many cases this valve would be located in the store, with the apparatus in the basement, so that the owner could start and stop the apparatus without going to the basement. Where this was done, an auxiliary valve was installed near the machine, so that the unit could be started and stopped by a serviceman testing or working on the unit.

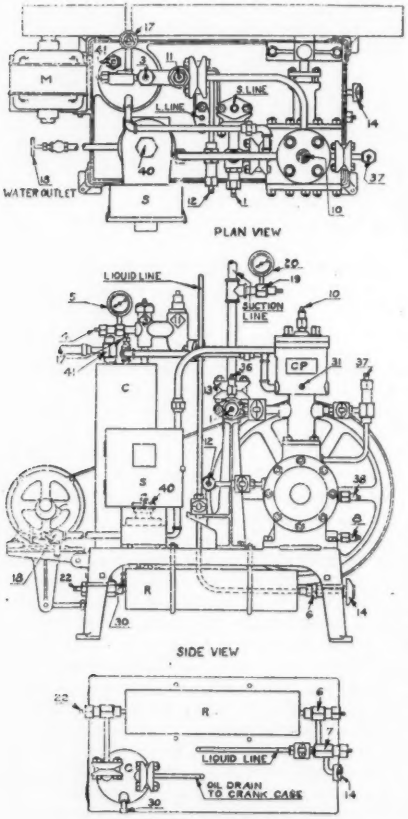

Diagram for No. 2 and No. 3 Machine.

FIG. 5

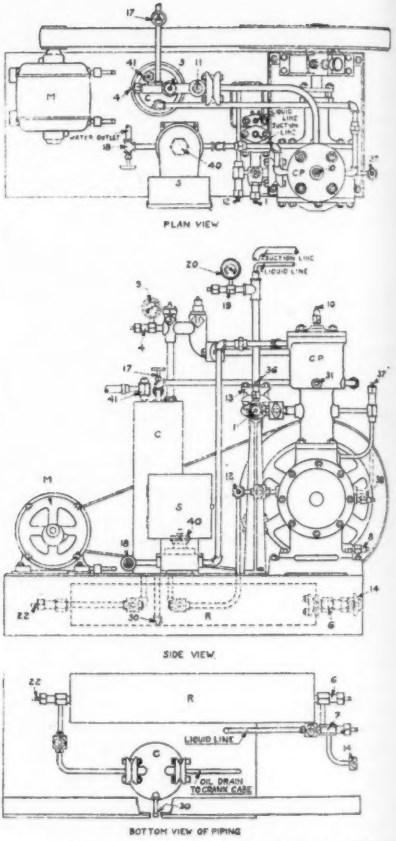

Diagram for No. 4, No. 5 and No. 6 Machine.

FIG. 6

It was desirable that no other stop valves be located in the line between the water inlet valve and the main shut-off valve on the supply line to the building.

The water outlet valve (18) was installed and connected to a waste line or sewer pipe. The drain line was provided with a continuous downward pitch from the point where connection was made to valve (18) and where it connected with the waste or

(Continued on Page 46)

RECOGNIZED FAVORITES

THE preference for ESOTOO and V-METH-L, the refrigerants with less than .003% moisture, is mounting higher and spreading more widely. These twin refrigerants of superlative quality are now the favorites with air-conditioning and refrigeration experts on every continent, because of their purity, their dependability and our rapid delivery service which encompasses the entire world.

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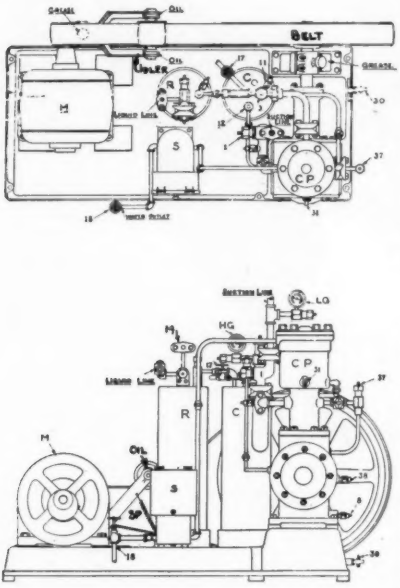
drain line so that there would be no danger of the line stopping up or being obstructed. This was very carefully followed in cases where the machine was located in quarters where the winter temperatures fell below the freezing point.



CP—compressor
M—motor
C—condenser
R—receiver
S—water switch
LG—low-pressure gauge
HG—high-pressure gauge

FIG. 7

The local plumbing laws in many instances require that the waste water drain into a sink or sump. In other localities the waste line can be connected directly to the sewer. It is really advantageous to have the waste line end in a sink or drain, as the flow of water can be visually observed and even tested if the machine is suspected to be leaking ammonia into the cooling water.

If a rise in the drain line was unavoidable due to the fact that the machine was located at a lower point than the connection to the waste pipe, or due to the fact that the drain had to empty into a waste sink, it was customary to insert a tee at the lowest point of the drain line and either make use of a pipe plug set in with graphite or of a regulation brass drain cock. This would permit the draining of water from the line, so that the machine could be made safe in freezing weather.

Water Switch Adjustment

The water switch was dependent upon water pressure for actuation and was adjustable through the pressure adjusting nut (40) as shown in illustrations 5 and 6. The pressure at which the switch would throw was governed by this adjusting nut. If turned to the left, the switch would throw at a lower water pressure, while if turned to the right, it required increased water pressure to operate it.

Switches were adjusted at the factory to throw on a water pressure of five pounds per square inch and it was found that this setting was satisfactory for nearly all installations. The setting should not be changed unless necessary.

Wiring

The water switch was provided with a starting switch and fuses for the motor. The water switch, motor and electric current supply had to be connected. Generally a cut-out switch was inserted in the electric line to be used as a manual control.

In the case of automatic control, the wiring connections included an automatic control panel and a thermostat installation in the refrigerator. The thermostat required careful placing in the refrigerator, for if located in a dead air pocket, in the cold or warm air current, or near the door, unsatisfactory control would result.

To Be Continued in October

In the coming issue, the author discusses further, piping the expansion valve, suction line, safety valves, adjustments, etc.

F. Y. Kane
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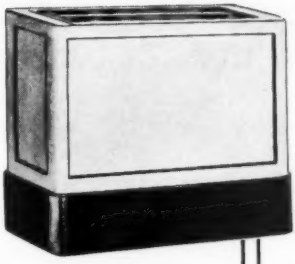

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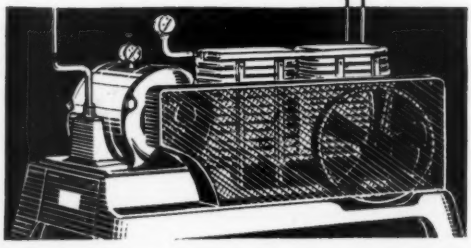

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REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

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A MESSAGE FROM THE PRESIDENT

DURING the first two weeks after mailing literature and plats for the exhibit space at the annual convention to be held in Chicago Nov. 3-4-5, over 50 per cent of the space was contracted for.

This report was given me at the end of the two week period and it proves that the Refrigeration Service Engineers Society is now firmly established and has been accepted by the industry as a sound organization thoroughly worthy of their support.

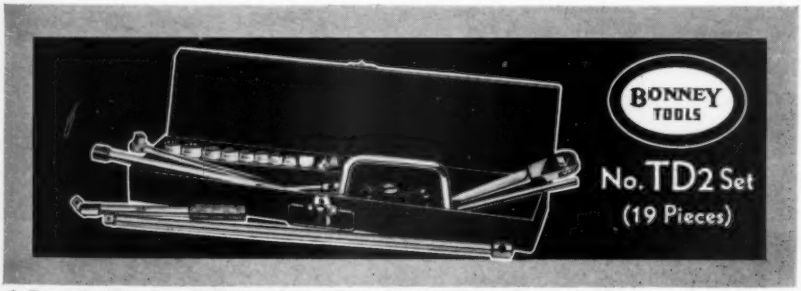
There is no more holding back by the manufacturers to see whether their competitors are going to exhibit, no more doubts in their minds as to whether it is worth the money and time they have to spend on their display, no more question about the people who attend this convention being the people they want to reach.

The last report shows that 100% of the exhibit spaces are sold and paid for and that we will have to open up additional spaces for the late comers. We are fortunate to be able to serve as many exhibitors as may apply for space.

The complete sell-out of the estimated requirements of space proves that at our conventions are assembled the greatest number of actual customers representing this phase of the industry; namely, the servicing business, the buyers of both original equipment and replacement parts for several million refrigeration systems.

At no other place is it possible to assemble all of these men, because at no other place do they cater directly to the refrigeration service engineer and at no other place do the entire activities center around this phase of the industry alone.

Here we are able to meet a great number of the manufacturers personally, and to hear them speak on their products, here we may meet with other men in the same line of endeavor in which we are engaged, and here we may participate in discussions on questions of vital interest to us alone. We do not have to spend time listening to speeches and talks which are of interest to some other branch of the industry, nor do we have to hunt around among many exhibits to find that which is of interest to us. Here we have everything of interest to us concentrated under one roof under the spon-



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sorship of the Refrigeration Service Engineers Society.

Make it a point to be at this convention, combine business with pleasure, and enjoy every minute of the time spent with the other members of the society, November 3-4-5 at the Stevens Hotel in the great City of Chicago.

PAUL JACOBSEN, *National President.*

100 PERCENT EXHIBIT SPACE SOLD

THE allotted space for exhibits at the annual convention of the Refrigeration Service Engineers' Society, to be held at the Stevens Hotel, November 3-4-5, has been subscribed for 100 per cent, necessitating the opening of additional space.

Referring to the plan published in the June issue, this additional space will be back-to-back with spaces 46 to 56, increasing the total width of the exhibit hall. A total of 65 spaces have been sold to date, or 87 percent of the newly allotted space.

New exhibitors, together with the space allotted to them, which have been added since the August issue, are as follows:

46—Bush Mfg. Co., Hartford, Conn.

57 and 58—Copeland Refrigeration Corp., Detroit, Mich.

63—Universal Cooler Corp., Detroit, Mich.

66—Weatherhead Co., Cleveland, Ohio.

The complete sell-out of the allotted exhibit space is without doubt a positive indication of the high degree of success of the coming convention. Such a splendid array of refrigeration equipment and supplies cannot help but draw a large attendance of members and visitors from all branches of the industry. This part of the convention alone will be a very liberal education to those who are interested in improving their methods and the equipment they use to that of the latest design.

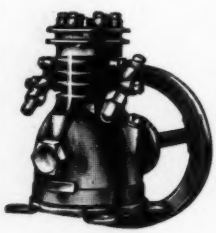
Without doubt, it will be the greatest show of its kind. Don't miss it! *November 3-4-5.*

MEMPHIS CHAPTER

IN reports just received from the Memphis Chapter is contained a record of the election of their officers for the fiscal year, as follows:

President—W. C. Easley

1st Vice-President—Hall Moss



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Chapter Representative—R. J. Rick
Chairman of Educational Committee—B. L. Bridges
Board of Directors: Boyd Evans, Bruce Killough, A. R. Black, I. L. Thompson.

At a later date, the following committees were appointed by the newly elected president:

Entertainment: Boyd Evans, G. W. Dotson, and J. H. Riehlmann
Finance: R. F. Weidlein, Bill Thompson and J. H. Riehlmann
Examining: B. L. Bridges, Bruce Killough and A. L. Black
Code and License: Hall Moss, B. L. Bridges and Boyd Evans
Grievance: Cecil Turner, B. L. Bridges and C. G. Gibson
Visiting: C. G. Gibson, and Ed Hunt
Local Publicity: Bill Thompson
Membership: Bill Easley.

The installation of officers took place at a dinner-dance, held on August 4, at the Mandarin Hotel. Members and their friends and guests turned out in full force for a very enjoyable dinner, after which everyone danced 'til the wee hour of two A. M. A good time was reported by all, with the hope expressed of more such affairs.

Meeting of Aug. 11, 1937

By J. H. RIEHLMANN, *Secretary*
3077 Summer Ave., Memphis, Tenn.

The regular meeting of the Memphis Chapter of the R.S.E.S. was called to order by President Easley.

Minutes of the previous meeting were read and approved.

Applications for membership: Wm. W. Canard, Associate; Herbert Ashworth, Associate; Herbert L. Passar, Associate; W. W. Waters, Associate.

President Easley appointed for the Audit Committee: Riehlmann, Weidlein and Boyd Evans.

Mr. Easley tendered his resignation as President of Memphis Chapter, owing to the

Come to the Convention
November 3-4-5

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WHEN you purchase gauges for use in air conditioning and refrigeration work you should ask yourself two important questions. First, are these gauges built with precision manufacturing methods and second, have the gauges proved that they can "take it" under service conditions?

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fact that he is going to New Orleans and would be in Memphis but once a month. The chapter would not accept his resignation, but gave him a thirty-day leave to find out if he would like his new position, and if not, he is at liberty to return to Memphis and be accepted back in his present office.

VIEWS AND REVIEWS

By HERMAN GOLDBERG

AT some time or other in every person's normal existence the question arises as to what becomes of the beautiful babies after they grow up. It is hard to figure just what element of human chemistry will take a beautiful, blue eyed baby and develop it into a gangling sour-puss, know-it-all, or other character. It certainly takes a lot of imagination to place the hard, bitten, disillusioned man in his 40's and 50's in the same trend of thought.

Nature, of course, has its elements in this transition, but the main ingredients seem to be supplied by the people whom we associate with in our everyday existence. It is practically impossible to gauge how much effect our friends and acquaintances, as well as personal enemies have upon our characters, but the fortunate person is one, who through circumstances is able to meet a preponderance of people who have cultivated better and more even ways of living and of earning a living.

Circumstances, however, are such that a great portion of the people do not have an opportunity of meeting others who may be indirectly beneficial to the building of their characters. This is one of the reasons why lodges and group associations flourish.

In our own individual field of endeavor, the Refrigeration Service Engineers' Society fulfills this unique position, as through its doors we have received not only members who are highly respected because of their top positions in the industry, but we have members whom we are proud of who are at the bottom ring of our business.

It stands to reason, of course, that the many types of men associated with the R. S. E. S. throughout the country have very few opportunities to get together except at our annual Convention, and, we have found in the past as we will again at our Chicago

Snap-on

SPECIALIZED TOOLS FOR REFRIGERATION SERVICE

The R-200B set (illustrated) is composed of units designed especially for installation and servicing of refrigeration equipment. It contains a reversible type ratchet with ¼" square opening for work on valve stems . . . 1½" extension . . . 2 adaptor plugs . . . 1 Kerotest valve packing nut socket . . . 5 square valve stem sockets . . . 5 packing gland nut sockets, and 7/16"-½"-9/16" double-broached Hexagon sockets. Available only through our own branch distributing warehouses located in 37 principal cities. See Snap-on Tools, Inc. in your city phone directory or send coupon below.

SNAP-ON TOOLS, INC.
KENOSHA, WIS.

☐ FREE Literature on refrigeration tools and 136-page FREE catalog.
☐ Show me No. R-200B Set.

Name .....

Address .....

..... RSE9

R-200B Refrigeration Set Designed especially for refrigeration work. Complete in metal box.

Convention this year, that the R. S. E. S. is a tremendous national organization of friends connected in the same industry.

Our conventions, as successful as they are, should not be looked upon only for the good times and educational features which we derive from them. Many men look for this time as a definite setting in which they can meet the greatest number of friends at a given place and on common ground.

As in all other new industries, tremendous fortunes have been made in refrigeration and air conditioning by men who started evenly with others, but because of circumstances were able to far surpass their old friends. These men welcome the dates of the R. S. E. S. Convention so that they can greet their old friends and talk about old times. For the new-comer, and the imaginative persons in our line of business, there is no finer way of making good associations than through meeting the fine body of men who will attend in Chicago in November.

"*YOUR* FRIENDS WILL BE AT THE CONVENTION."

THE "CONTRIBS' COLYUM"

By THE KINGFISH

A HOT and hectic summer has passed the zenith once more, and we can again breathe a little more freely and snatch a few hours' sleep at night. How has your income been?

Absolutely TIGHT CONNECTIONS with these fittings

THE success of any refrigeration or air conditioning system is absolutely dependent upon tight connections.

Imperial fittings in both S. A. E. flared types and solder fittings have been especially designed for refrigeration work—they are not a worked over line of automobile couplings. You can feel certain that they will remain tight throughout the entire life of the installation.

IMPERIAL BRASS MFG. CO.
1204 W. Harrison St., Chicago

S. A. E. FLARED FITTINGS

Nuts, tees, elbows and crosses are made from brass forgings and will not crack or split. These fittings are heavier and stronger than the standard S. A. E. fittings and are non-porous, eliminating seepage and season cracking. Tees and elbows have flats for wrench. Imperial fittings are furnished in a complete variety of types and sizes for every need.

SOLDER FITTINGS

Imperial solder fittings (licensed under Streamline patents) assure an absolutely tight connection that is actually stronger than the tube itself. It is lighter, simpler and more quickly fitted than conventional fittings. No flaring required. Imperial solder fittings are forged except some types which are also furnished in wrought. Broad range of elbows, tees, return bends and other fittings for tube diameters from ¼" to 2⅝".

IMPERIAL Fittings ORDER FROM YOUR JOBBER

VALVES · TOOLS · CHARGING LINES · FLOATS · DEHYDRATORS · STRAINERS

We see that the editor has a new assistant, Harry Busby, and that he is busy writing editorials and general articles.

We hear that Paul Jacobsen's bookkeeping system reveals his venture into the chicken business rather unprofitable, but he is determined to "get his price" even if it must be $1.00 per lb. Is the reduction from 500 chicks to 200 chickens due to natural losses, Paul, or to a healthy appetite?

HERMAN GOLDBERG CO.

Manufacturers' Agent

ANSUL CHEMICAL CO.
Sulphur Dioxide—Methyl Chloride

AMERICAN INJECTOR CO.
—Valves

RANCO
—Controls

STANDARD REFRIGERATION CO.
Evaporators—Condensers

9 S. CLINTON ST., CHICAGO

Shop Practice Included

Nothing has been overlooked to make U. E. I. training thorough and practical in every respect. Following the spare time home study that gives the principles of refrigeration and their practical application to ALL TYPES of equipment, U. E. I. men get two weeks of actual servicing and installing experience on all types of household and commercial refrigerating equipment.

U. E. I. trained men are fully trained. Some are available NOW.

Utilities Engineering Institute

404 N. Wells Street — Chicago
17 W. 60th Street — New York

So many new chapters are being formed that we can hardly keep up with them, but we extend a cordial welcome to all the new members and the new chapter officers.

We hear that McCauley has announced Pittsburgh is in the race for the 1938 convention and that they have the backing of the various civic authorities. Good luck to you, Pittsburgh.

From all reports, our convention committees in Chicago are going strong and according to these reports, we shall have a real pacemaker of a convention.

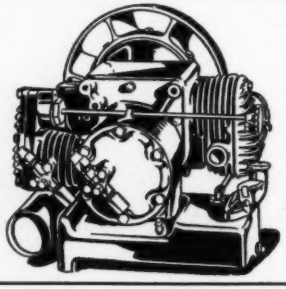
We read that the shape of a B.t.u. has finally been determined—IT IS SQUARE. If you do not think so, just ask Ray Polley of Mills Novelty Co.

100% of the exhibit spaces sold at the last report—there certainly will be something to look at during the week of the convention.

It appears that the jobbers are still selling parts to individuals at the same prices quoted service companies. We were under the impression that the National Jobbers' Association was to control and curb these practices.

Have you received your 1938 membership certificate yet? Hurry, hurry, hurry! After September 1, you stand temporarily suspended if your dues are not paid.

It is rumored that the latest addition to Paul Jacobsen's business ventures is a gasoline service station. How about it, Paul? Is this just "Gas" or have we heard correctly?



Ice Engine—Gasoline Powered

Engine and Compressor one balanced Unit designed and built by the largest manufacturers of Gasoline Engines in the World.
Compressor, 2¼x1½ is driven at 625 RPM, one-half Engine Speed, and is oiled for life. Engine displacement—8.95 cu. in. Compressor—5.96.
Ideal for grocery and delicatessen Cabinets, medium size display and Freezer Cases, Ice Cream Cabinets, Soda Fountains, Milk Coolers; Multiples of domestic Cabinets or small commercial Units.

Price reasonably low, liberal dealer discount

Send for Free Illustrated and Descriptive Folder of Ice Engine and Netco Milk Cooler

NATIONAL ELECTRIC TOOL CO.
Dept. R2 — 558 W. Washington St., — Chicago, Ill.

TOLEDO SERVICEMEN APPLY FOR NATIONAL CHARTER

THROUGH the courtesy of the Toledo Edison Company, the assembly hall was provided for preliminary meetings of a group of servicemen interested in the formation of a local chapter of the R.S.E.S.

Mr. A. J. King, who has been a member-at-large of the Society for a number of years, was elected Temporary Chairman, and Mr. H. C. Benington, Temporary Secretary. At a meeting on August 26th, National Secretary H. T. McDermott, was present to discuss the purposes and objects of the national organization, and to outline the procedure necessary for application for a charter for the local chapter. Accordingly, a petition for charter was signed by approximately 25 members, and arrangements made for the definite establishment of Toledo Chapter. All servicemen located in the vicinity of Toledo are invited to affiliate themselves with this newest chapter.

S S S

UNIQUE PROGRAM PLANNED FOR R.S.E.S. CONVENTION

ONE of the more important convention committees actively at work is the Program Committee, which will present the educational part of the convention.

The program is planned so that the authors of the various papers can place their subjects before the convention in an interesting, comprehensive and instructive manner. The program will be confined to the hours of 10 a.m. to 1 p.m.

The Entertainment Committee will have a number of prizes to award for various activities, such as door prizes for the banquet, keno games for the ladies, and, of course, a number of prizes for the big Monte Carlo night, which will be held in the exhibit hall on the second day of the convention.

S S S

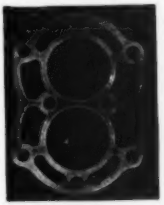
J. Sherman Covert
Michigan

Sincere wishes for the successful continuance of your excellent magazine.

Chas. A. Wilhelm
New York

I would like to take this opportunity to say THE REFRIGERATION SERVICE ENGINEER is the best help a serviceman could have.

REPLACEMENT GASKETS FOR ALL MAKES



Metallic Gaskets that hold regardless of what the refrigerant may be and will not shed particles of material to clog up important working parts in a machine.

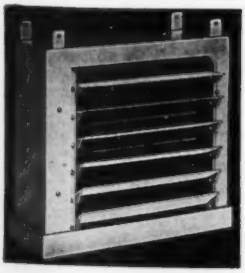
Send for catalog listing many "orphans" not available elsewhere.

CHICAGO-WILCOX MFG. CO.
7701 S. AVALON AVE., CHICAGO, ILL.

General Electric, Westinghouse, Majestic, Gibson-Hermetic Units Rebuilt or Repaired

Complete MACHINE SHOP SERVICE on all makes of both domestic and commercial units. All units completely tested and guaranteed. Write for our latest price list.

ALLIED REFRIGERATION PRODUCTS CO.
1947 Flushing Avenue Brooklyn, New York



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Pipe Coils
Air-Conditioning Coils
FIN COILS
5/8" - 3/4" - 1"
Steel or Copper
REMPE COMPANY
340 N. Sacramento Blvd. • Chicago, Illinois

REMPE

MILLS COMPRESSORS

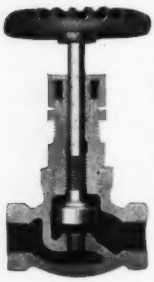
★ FOR COMMERCIAL USE

Mills Novelty Company
4100 Fullerton Ave., Chicago, Ill.

Sold Only Through Servicemen, Dealers and Distributors

COMPLETE STOCK OF
REFRIGERATION PARTS
— TOOLS — SUPPLIES
ONE DAY DELIVERY
Write for Catalog & Price Challenger
Wholesale Only
REFRIGERATION PRODUCTS, Inc.
122 W. Illinois St., CHICAGO, ILL.

KRAMER
COIL PRODUCTS
— A Complete Line
Send for Catalog
TRENTON AUTO RADIATOR WORKS
TRENTON, N. J.
Kramer Auto Radiator Corp., New York, N. Y.
Kramer Auto Radiator Co., Pittsburgh, Pa.



Krupp Valves & Water Regulators

for Ammonia Service

Our semi-steel valves have new features: the improved swivel seat, *new bonnet construction* and pressure cap lock. All valves contain the highest grade metallic packing.
Descriptive literature mailed upon request.

for Methyl-Freon-Sulphur

Water valve body is made of cast bronze and has renewable rubber composition seat. Noiseless in operation. The frame is so designed that adjustments can be made easily. Operating range from 50 to 150 lbs.

CYRUS SHANK CO.
625-631 W. Jackson Blvd., CHICAGO, ILL.
Manufacturers of Krupp Valves for Mechanical Refrigeration

SERVEL PARTS TO BE SOLD THROUGH JOBBERS

A RECENT announcement by P. B. Reed, service manager of Servel, Inc., states the following:

"For many years, it has been our aim and policy to make Genuine Servel parts readily available for the repair of Servel electric domestic and commercial equipment. We have cooperated closely with responsible independent service companies, many of whom have been privileged to advertise as 'Authorized Servel Service.' With few exceptions, our trust in these organizations has been well placed. Most of them have been found to be competent, earnest and reasonable in their charges. To further cooperate with such organizations, we are inaugurating a plan that will enable servicemen to obtain Genuine Servel Parts more quickly and more easily by merchandising these parts through refrigeration supply jobbers.

"It is anticipated that this widening of the channel of distribution will react to the benefit of the user and to the advantage of the serviceman in the increased assurance that Genuine Servel Parts are quickly available from a nearby source. Few will question but that the equipment manufacturer should be best able to supply the replacement parts that are the most suitable to use in repairing his equipment. He is more intimately familiar with all the factors to be considered in the design, material, processing and production of the part. Moreover, due to the large quantities in which he manufacturers, he is better able to put full quality in the part at the lowest price.

"Stocks of the most commonly used parts will be maintained by supply jobbers in various cities selected to most promptly and effectively serve the trade. The names of these jobbers will be made public in the near future."

S S S

AIRO SUPPLY CONDUCTS WORLD SERIES CONTEST

IN connection with a drive for new customers, the Airo Supply Co., of 2726 N

TRY THIS THERMOMETER ON 15 DAY TRIAL

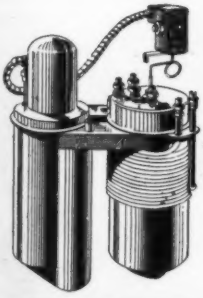
● Here is a reliable recording thermometer at a price you can afford. Only $18! Designed particularly for service work. You must see it to appreciate its exclusive features; to learn why it is easy to operate. Hundreds use Practical thermometers to check refrigerators, air-conditioners, etc. Find out all about this instrument. Ask your jobber or write to us.

SEND FOR TRIAL OFFER

Mail this ad with your letterhead to get latest folder on this amazing instrument and 15 Day Trial inspection offer.

PRACTICAL Recording Thermometer

Practical Instrument Co., 2717 G No. Ashland, Chicago



COLTROL

DIAL IN THE TEMPERATURE YOU WANT

LIQUID COOLER

A Source of Quick Profits

Easiest to sell. For beer, root beer, water, carbonated drinks, etc. Fits standard beer coil box. Perfect foam control. Accurate. Costs less to install and operate. Permits steam or chemically cleaning of beer coils. All refrigerants.

COMMERCIAL COIL & REFRIGERATION CO.
459 North Artesian Avenue, Chicago, Illinois

. . SEE YOUR JOBBER OR WRITE DIRECT . .

Ashland Ave., Chicago, Ill., is conducting a new contest which offers as a prize, a free trip with all expenses paid, including transportation, hotel and meals, to the World Series.

In order to win this attractive prize, all you need do is send a letter, stating in 50 words or less why you like to buy from the Airo Supply Co., and giving them an original slogan to go with their name.

A folder now available, giving the details and rules of the contest, may be obtained from Airo Supply Co., if you have not already received your copy.

DENNIS GASKETS

FOR ALL MAKES REFRIGERATOR DOORS

A complete line of rubber - coated, packed Gaskets and extruded rubber Gaskets that last longer —retain higher efficiency—because made of finest materials and workmanship. Write for free samples, giving your jobber's name and address.

W. J. DENNIS & CO.
2110-20 WEST LAKE ST. ··· CHICAGO

PARTS A complete line of standard parts carried in stock at all times

TOOLS Everything you need to do a better and faster repair job

SUPPLIES The best there is on the market. Write for catalog

H. W. BLYTHE COMPANY
WHOLESALE ONLY
2334-38 South Michigan Ave., CHICAGO, ILL.

FEDDERS ISSUE NEW BULLETIN A537

A NEW 55-page bulletin, Number A537, has just been released by Fedders Manufacturing Co., of Buffalo, N. Y.

This bulletin, similar to but much larger than the former one of its kind published, contains a reprint of the Engineering and Service Articles, by Joe Askin, appearing in the Fedders News. The many requests for this book have necessitated a re-issue, which has been enlarged to accommodate the more recent material.

The service engineer will find contained in the bulletin, an interesting section devoted to service tips, which are well worth knowing. If you haven't already received a copy, you may obtain one from the Fedders Manufacturing Co.

S S S

PENN ELECTRIC ANNOUNCES RECENT PERSONNEL CHANGES

PAUL O. PENN, formerly manager of Penn Electric Switch Co.'s Detroit Office, has been named assistant to Malcom E. Henning, Penn executive vice-president, in an announcement issued recently by Mr. Henning. In this position, Paul Penn will be located at the company's new office and factory at Goshen, Indiana.

At the same time, Mr. Henning announced the appointment of P. L. Tolerton as manager of Penn's Detroit office.

"This transfer of Mr. Penn and addition of Mr. Tolerton to our staff have been made," said Mr. Henning, "to enable Penn Electric Switch Co. to maintain a much closer contact with customers in the heating, refrigeration, air conditioning, pump and air compressor fields.

"Mr. Tolerton, a graduate engineer, has had much experience in the control field.

Condensing Unit Style D7-MA

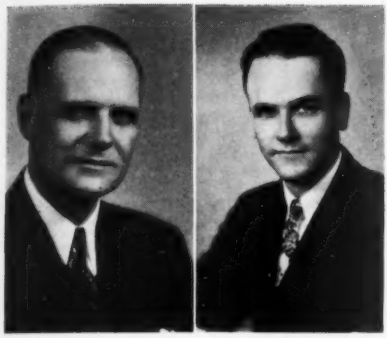
STARR FREEZE

DEPENDABLE COMPRESSORS AND CONDENSING UNITS
1-2-4 Cylinders—⅛ to 10 H.P.

The most profitable and complete line to select from—just the size to build that refrigerator,—to assemble that condensing unit or to replace that old worn-out compressor.

Compressor Style J

THE STARR COMPANY, Richmond, Ind., U. S. A.
222 N. Vermont Ave. Los Angeles, Calif.
2025—1st Ave. North Birmingham, Ala.
1222 Huron Road Cleveland, Ohio



P. L. TOLERTON P. O. PENN

For several years he was in charge of Penn's Chicago office. He also has had broad sales and engineering experience in the commercial refrigeration field.

"Mr. Penn, also a graduate engineer, has been in charge of our Detroit office for six years. Prior to that time he was connected with Westinghouse Electric and Mfg. Co. in the heavy traction sales division."

S S S

GILMER APPOINTS NEW DISTRICT MANAGER

THE L. H. Gilmer Co. announces the appointment of William S. Foley as District Manager of the Pittsburgh territory for Gilmer Belts for electric refrigerators, washing machines, pumps and other small drives. His office is in the Clark Building.

S S S

TAG ISSUES NEW CATALOG

A NEW 56-page book entitled "TAG Indicating & Recording Temperature and Pressure Instruments" has just been published. It is more than a regular listing catalog for it presents information in a clear, understandable way on the latest TAG developments, many of which have never before been published.

Complete data will be found on indicating and recording controllers for temperature and pressure, recording thermometers, recording pressure gages and dial indicating thermometers.

The many illustrations not only show how these pressure spring instruments operate,

SAVE TIME and MONEY!

IDEAL Solderless Tapeless WIRE CONNECTORS

BETTER ELECTRICALLY—STRONGER MECHANICALLY

Take the place of more expensive, solder, tape and blow-torch method, eliminating open flame hazards. Widely used by Refrigeration Engineers because they are—

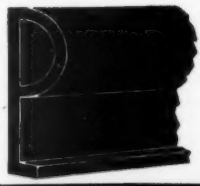
SAFER! BETTER! QUICKER!

No tools required. Simply thread on with the fingers. Unaffected by heat, cold or moisture.

Fully approved. Listed by Underwriters' Laboratories.

IDEAL COMMUTATOR DRESSER CO.

1093 Park Ave. Sycamore, Illinois



● Every month we tell you about another replacement gasket. Watch this space regularly. JARROW gaskets are made to the manufacturers' specifications. *Insist on Jarrow gaskets for replacement.*

JARROW PRODUCTS CORPORATION

420 N. LaSalle St., Chicago, Ill.

Write for New Catalog of

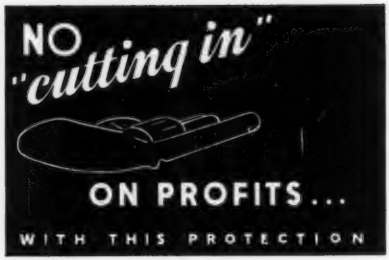
PARTS·SUPPLIES·TOOLS

for REFRIGERATION *and* AIR CONDITIONING

Complete Stock—Quick Service—Money-saving Prices

EVERTHING YOU NEED FROM ONE SOURCE

AIRO SUPPLY CO. CHICAGO: 2732 N. ASHLAND AVE. NEW YORK: 17 W. 60th ST. (at Broadway)



Worn cylinders and inefficient piston seal are gangsters that "cut in" on every cent of profits a compressor aims to produce. Running time is longer, power cost is greater, wear and tear proceeds at a faster pace. But when you put Silver Seal Piston Rings—the rings with the white bearing metal insert—on the trail, this larceny is stopped—cold!

Here's the understandable superiority of Silver Seal Rings. The babbitt metal insert—two in wider-faced rings—is supported by and projects beyond the face of the ring. This anti-friction metal quickly conforms to cylinder irregularities, burnishes the wall of the cylinder and provides a perfect seal. It stops scuffing and scoring, and, in performance, turns back time to "new" efficiency. Where rings are subjected to high heat, bronze bearing metal inserts should be specified.

Silver Seal Rings have been so widely adopted that they are practically standard equipment. They are regularly giving a full year of faultless service without need of replacement. Send today for the Silver Seal folder.

Among users of Silver Seal Piston Rings:
FRICK COMPANY
YORK ICE MACHINERY CORPORATION
CREAMERY PACKAGE MANUFACTURING CO.
BAKER ICE MACHINE CO., Inc.

THE SKINNER CHUCK COMPANY
344 Church Street NEW BRITAIN, CONN.

Also manufactured and distributed under license by:

American Hammered Piston Ring Division
of Koppers Company BALTIMORE, MD.

"The World's Largest Manufacturer of Industrial Piston Rings"

but the practical installation photographs tell an interesting story of how so many TAG instruments are serving the process industries.

A copy of this new book with the latest instrument information will be sent on request. Address C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. Ask for Catalog No. 1060C.

H. CHANNON CO. TO AID DEALERS GET FALL BUSINESS

JUDGING from the reports secured from the H. Channon Company, the service men are quoting many prospective customers on "Chanco Units." An active fall business on commercial sales is definitely to be expected.

The H. Channon Company, through the financing of dealer sales, state that they are in a position to assist every service man in getting his rightful share of this type of business.

Our observation is, that as service work slackens, the service man who is on his toes can go into the field and definitely make a good showing selling replacements to many of his own customers, make a substantial profit, and at the same time, render a definite service to the user.

MORAVEC PUT IN CHARGE OF PENN'S NEW MOLINE OFFICE

MR. J. G. MORAVEC, sales engineer, has been placed in charge of Penn Electric Switch Co.'s Moline Office at 585 Fifth Avenue Building, Moline, Illinois, according to an announcement recently released by N. E. Jennison, assistant sales manager, Penn Electric Switch Co.

J. G. MORAVEC

"The office, which was opened July 1, coincident with the moving of the company's executive offices to their new factory and office at Goshen, Indiana, will serve western Illinois and Wisconsin, Minnesota, Iowa, Nebraska and Dakota customers," Mr. Jennison said. "This will enable Penn Electric Switch Co. to keep in the same intimate contact with customers in that territory, as it did prior to its move."

Mr. Moravec is a mechanical engineering graduate of the University of Iowa. Prior to joining Penn Electric Switch Co., he was connected with the United Power and Light Co., Davenport, Iowa. He had served as sales engineer in the company's Des Moines office for some time before his transfer to the post as manager of the Moline office.

* * *

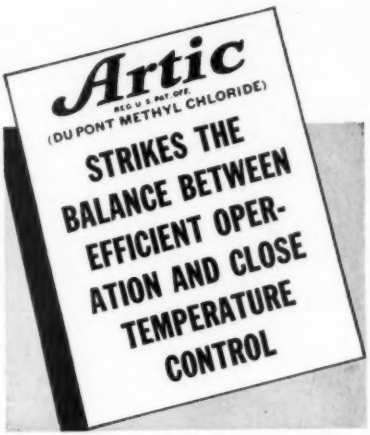
MINNEAPOLIS-HONEYWELL INCREASES SPACE IN THREE CITIES

MINNEAPOLIS-HONEYWELL again went office-hunting recently in three more cities as increased business demanded immediate expansion moves in Boston, Pittsburgh and Indianapolis.

The Boston branch office of the Minneapolis-Honeywell Regulator Company doubled its floor space by moving into the Kenmore Square district at 797 Beacon Street where the entire second floor of the building was taken at that address. Approximately 9000 sq. ft. of floor space will now enable the Boston office to carry an even greater stock to meet the rapidly increasing demand for Minneapolis-Honeywell controls and control systems in that district for heating, ventilating and air conditioning.

The location moves in both Pittsburgh and Indianapolis were also made to increase operating space. An open house was held August 6th in Pittsburgh to acquaint the industry with Minneapolis-Honeywell's improved facilities at 26th and Sarah Streets. The new Indianapolis district office at 1134 North Pennsylvania Street has been increased to include separate quarters for general, engineering, service and sales offices as well as for display rooms.

These new offices, as well as the sixty-six other Minneapolis-Honeywell offices in all principal cities, are equipped to supervise, adjust and service Minneapolis-Honeywell instruments or those manufactured by its Brown Instrument Division or National Regulator Division.


Artic
REG. U.S. PAT. OFF.
(DU PONT METHYL CHLORIDE)
STRIKES THE BALANCE BETWEEN EFFICIENT OPERATION AND CLOSE TEMPERATURE CONTROL

VOLUME of liquid ARTIC needed for a specific refrigeration effect is just right—not so great that it interferes with efficient and rapid cooling and not so small that it hinders accurate temperature control. That's balance, just another of the essentials which makes ARTIC a Preferred Refrigerant.

ARTIC—*the Preferred Refrigerant for Service Work*

DU PONT
REG. U.S. PAT. OFF.

E. I. du Pont de Nemours & Co., Inc.
The R. & H. Chemicals Dept.
Wilmington, Del.
District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

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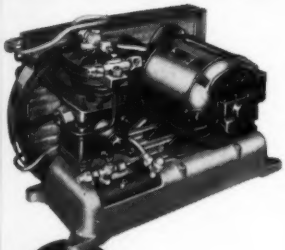

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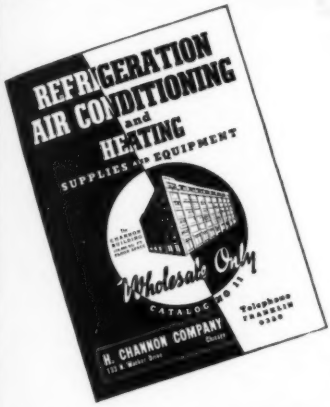

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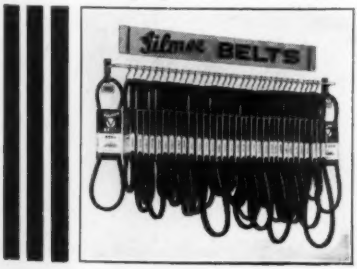

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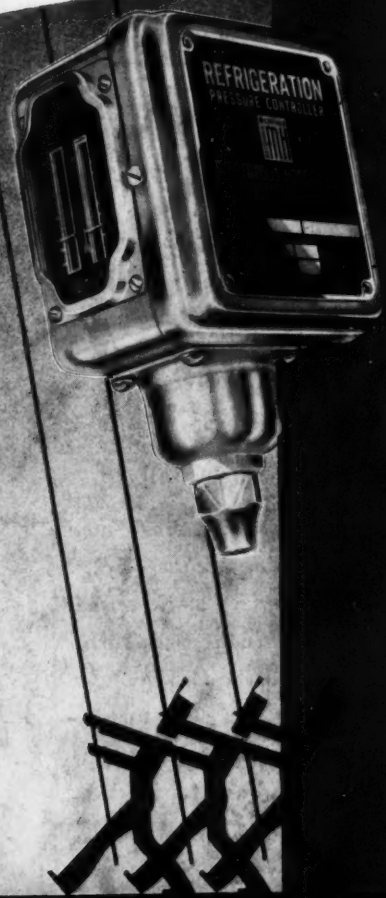

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